Engineering Library

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VOL. CL.—No. 3888] LONDON: FRIDAY EVENING, JULY 18, 1930 [PRICE { WITH INDEX AND OTHER SUPPLEMENT } 1s. 6D. BY INLAND POST 1s. 9d.

JUL 30 1930

PUBLIC NOTICES

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11a.m. on Thursday, 31st July, 1930, for ACCELERATED LOW-PRESSURE HOT WATER HEATING, &c., at the County Court, Harlesden, N.W.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 5423

Air Ministry. DIRECTORATE OF TECHNICAL DEVELOPMENT.

TEMPORARY DRAUGHTSMAN REQUIRED for work at the Aeroplane and Armament Experimental Establishment, Royal Air Force, Martlesham Heath, Suffolk. Candidates must have received a good engineering training, preferably on aircraft, in workshop and drawing-office practice. They must be capable of measuring up and making working drawings and neat tracings.

Preference given to ex-Service man.

Salary up to 52s. a week plus Civil Service bonus (giving present total of 82s. a week), according to qualifications and experience.

Application should be made to the SECRETARY, Air Ministry (S.2), Adastral House, Kingsway, W.C. 2. 5401

Crown Agents for the COLONIES.

COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/2015.—ASSISTANT ENGINEERS REQUIRED by the GOVERNMENT of NIGERIA, for the Public Works Department, for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service, the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. Salary £480 a year for the first three years; then £510 rising by annual increments to £920. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates must have attained the age of 21½ years on the date of appointment, and should preferably have attained the age of 22½ and must not be over 35 years of age. Must have obtained an Engineering Degree at a recognised University or have passed Sections "A" and "B" of the A.M. Inst. C.E. examination or have passed the Associateship in Civil Engineering of the City and Guilds Institute, or possess such other degree or diploma or distinction in Engineering as may be considered satisfactory. Candidates whose qualifying diplomas have been obtained without a college course, should have had three years' practical experience of Civil Engineering under a qualified Civil Engineer. It is preferred that all candidates should have had two years' practical experience on good engineering work subsequent to taking their degree or completing their articles, but under certain conditions this may be waived in the case of candidates in possession of an Engineering Degree.

M/2065.—ASSISTANT ENGINEER REQUIRED by the GOVERNMENT of TANGANYIKA TERRITORY for Roads Construction, for a tour of 20 to 30 months' service. Salary £480 to £600 a year, according to experience and qualifications. Outfit allowance of £30 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, 28-35 years of age, must have had experience of Railway or Road Contracting Engineer's Work abroad; must be able to undertake the Construction of Earth and Gravelled Roads, including Earthworks, Steel, Reinforced Concrete and Timber Bridges and auxiliary works. Preferably should have had experience of Survey and Location Works, and preferably should be Associate Members of the Institution of Civil Engineers.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 5438

The University of Sheffield. SESSION 1930-31.

Vice-Chancellor: A. W. PICKARD CAMBRIDGE, M.A., D.Litt.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular Courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' Courses of study at the University and six months' practice at the works or colliery each year for a period of four years. During the first year such students should spend three terms at the University.

RESEARCH Fellowships and Scholarships are awarded annually.

The LECTURE COURSES commence OCTOBER 1st, 1930.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 23rd, 1930.

Particulars of Entrance and Research Scholarships available will be sent on application.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS, Registrar.

5378

SITUATIONS OPEN

WANTED by Old-established English Company in Valparaiso, YOUNG ENGINEER (B.Sc. Eng'g., or Assoc. M. Inst. C.E.), under 30 and unmarried, with experience in modern Treatment of Sewage. Salary £575 per annum. First-class passage paid.—Write to E. M., c/o J. W. Vickers and Co., Ltd., 24, Austin Friars, E.C. 2. 5398 A

The Engineer

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PUBLIC NOTICES

Robert Gordon's Technical COLLEGE, ABERDEEN.
(CENTRAL INSTITUTION.)

The Court of the University of Aberdeen and the Governors of Robert Gordon's Colleges co-operate in the provision of courses leading to the Pass and Honours Degrees of B.Sc. (Engineering) of the University and to the Associateship of the Colleges in the Departments of :—

CIVIL ENGINEERING,
MECHANICAL ENGINEERING,
ELECTRICAL ENGINEERING.

Full-time Day Courses in Mechanical and Electrical Engineering lead to the Higher National Diplomas in these subjects.

Prospectuses forwarded gratis on application to the SECRETARY and REGISTRAR, Robert Gordon's Colleges, Aberdeen. P56

South Indian Railway Com- PANY, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. STEEL TYRES for LOCOMOTIVE ENGINES and TENDERS.
2. STEEL DRAWBARS, &c., for WAGONS; and
3. SPARE PARTS for LOCO. ENGINES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked, "Tender for Steel Tyres for Locomotive Engines and Tenders," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 1st August, 1930.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of Specification No. 1, and of 5s. for each copy of Specifications Nos. 2 and 3.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD, Managing Director.

91, Petty France,
Westminster, S.W. 1.
16th July, 1930. 5430

PUBLIC NOTICES

Administrative County of LONDON.

WIDENING OF PUTNEY BRIDGE.

The London County Council invites TENDERS from competent firms for the WIDENING of PUTNEY BRIDGE by adding about 30ft. to the width of the existing structure. The arches of the bridge will be extended on the downstream side, in granite matching in all respects the existing part of the bridge, and the piers in granite-faced concrete founded in caissons sunk in the river bed. The addition to the abutments will be carried out in granite-faced concrete matching the existing work. The contract will also include the formation of the roadway on the widened bridge and its approaches immediately adjacent and the relaying of the tramways in the centre of the widened carriageway.

The specification, bills of quantities, drawings and form of Tender may be obtained, on and after 14th July, 1930, on application to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1, upon payment of £10 by cheque, draft, or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee.

Remittances by post should be addressed to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 2A, No. 3, Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 1st September, 1930, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX, Clerk of the London County Council.

5361

RAILWAYS.
CARRIAGE UNDERFRAMES AND WAGONS
(Metre and 2ft. 6in. Gauge).

The Consulting Engineers to the Mysore Railways (Messrs. RENDEL, PALMER and TRITTON, 55, Broadway, Westminster, S.W. 1) invite TENDERS for CARRIAGE UNDERFRAMES and WAGONS.

Specifications and Tender forms may be obtained from their office on payment of 5s. (which will not be returned).

Tenders must be submitted not later than Thursday, 7th August, 1930. 5430

PUBLIC NOTICES

Administrative County of LONDON.

DEPTFORD PUMPING STATION—STORM WATER DISCHARGE CULVERT TO RIVER THAMES.

The London County Council invites TENDERS for the CONSTRUCTION of a CONCRETE CULVERT, 9ft. 6in. by 13ft. internal dimensions, principally in open cutting, in Church-street and Billingsgate-street, Greenwich, total length approximately 972ft., including a SHORT LENGTH of 11ft. 6in. internal diameter CULVERT in Cast Iron and Concrete; the CONSTRUCTION of a FLAP CHAMBER and an OUTLET into the River Thames, consisting of Three Lines of 6ft. internal diameter Cast Iron Pipes at Billingsgate Dock; the CONSTRUCTION in TUNNEL of approximately 260 Lineal Feet of 5ft. internal diameter BRICK SEWER in Church-street; and other works, all in the Borough of Greenwich, in the Administrative County of London.

It will be a condition of the contract that the work must be actively commenced by 30th September, 1930, and the contractor must comply, as regards the employment of labour, with the terms and conditions laid down by the Unemployment Grants Committee.

The specification, bills of quantities, drawings and form of Tender may be obtained on application to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1, upon payment of £10 by cheque, draft or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee.

Remittances by post should be addressed to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 3A, No. 3, Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 18th August, 1930, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX, Clerk of the London County Council.

5408

Applications from Qualified CIVIL ENGINEERS are INVITED for the POST of EXECUTIVE ENGINEER (permanent) to the Public Works Department, Jodhpur State, Rajputana, India.

Candidates should be in the neighbourhood of 32 years of age, Public School or University, and be possessed of A.M. Inst. C.E., or an exempting degree.

Preference will be given to those having had intimate experience of WATERWORKS and Drainage, in addition to Roads and Buildings.

Initial salary will be determined by age, based on an initial figure of Rupees 500 per month up to age 24, increased by Rupees 50 per month for each year of greater age. Rupees 50 per month increase each year of service.

Free quarters simply furnished, free motor car and passages. Provident Fund in lieu of pension. Leave according to State Rules.

Medical examination.

Further particulars available from the Publisher, THE ENGINEER (Box P1000), 28, Essex-street, W.C. 2.

Apply at once by Air Mail letter, stating age, married or single and giving full particulars, qualifications and experience, to S. G. EDGAR, I.S.E., Superintending Engineer, P.W.D., Jodhpur, Rajputana, India. 5440

County Borough of Derby. APPOINTMENT OF CHIEF RESIDENT ENGINEER.

The Corporation REQUIRE the SERVICES of a CHIEF RESIDENT ENGINEER in connection with the Construction of Works for the Improvement of the Channel of the River Derwent, including Weirs, Sluices, Cuts, &c., and Extensions to the Sewage Disposal Works, embracing Filters, Humus Tanks, &c.

Applicants must be fully conversant with and thoroughly experienced in the duties of a Resident Engineer in charge of public works carried out either by contract or direct administration.

The appointment will be for the period of construction (subject to satisfactory service), which, it is estimated, will occupy between two and three years.

The person appointed will be required to act under the direction of the Corporation's Consulting Engineers.

Salary £750 per annum.

Applications, on the prescribed form, which may be obtained at this office, stating age and qualifications, together with copies of not more than three recent testimonials, and endorsed "Appointment of Chief Resident Engineer—River Improvement and Sewage Disposal Works," should be delivered to me not later than August 5th next.

G. TREVELYAN LEE, Town Clerk.

Town Clerk's Office,
Market Place, Derby. 5423

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PUBLIC NOTICES

Public Works, Roads and Transport Congress, 1931.

PAPERS COMPETITION.

The Congress Organising Committee have decided to offer the following prizes for Papers submitted for discussion at the 1931 Congress:—

1st Prize—Gold Medal and fifty guineas.
2nd Prize — Silver Medal and thirty guineas.
3rd Prize — Bronze Medal and fifteen guineas.
4th Prize—Ten guineas,

with a prize of five guineas for each Paper (excluding those for which the principal prizes are awarded) selected for discussion.

Paper must be submitted not later than the 31st December, 1930.

Application for the rules and particulars of the competition must be made to the Hon. Secretary, Public Works, Roads and Transport Congress, 84, Eccleston Square, London, S.W. 1.

Papers may be submitted for discussion without being entered for competition. Such papers should be clearly marked "Not for competition."
5429

Great Southern Railways.

JUNIOR DRAUGHTSMAN.

The Directors of the Great Southern Railways REQUIRE the SERVICES of a JUNIOR DRAUGHTSMAN.

Applicants should not exceed 25 years of age and should have experience in Civil Engineering. Commencing salary £150 per annum.

Applications should state age and give full particulars of training and experience, be accompanied by not more than two copies of recent testimonials, and should be posted so as to reach the undersigned not later than 5 p.m. on the 11th August, 1930.

H. S. COE,
Secretary.

Kingsbridge Station, Dublin, W. 6,
July, 1930. 5417

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, CIVIL ENGINEER for Oilfields in Northern Iraq.

Must be an Associate Member of the Institution of Civil Engineers or possess some equivalent qualification. Must have had experience in General Civil Engineering Work, particularly Roads and Water Supply, and be able to take charge of constructional work.

Must be unmarried or willing to proceed abroad without wife for an indefinite period.

Initial salary £620 per annum or more, according to qualifications.

Apply by letter, stating fully, qualifications, age, &c., to IRAQ PETROLEUM CO., Ltd., King William Street House, Arthur-street, London, E.C. 4.
P83 A

WANTED, ESTIMATOR, RATE-FIXER, thoroughly experienced in Millwrighting and General Building Works.—Address, stating experience and salary required, 5412, The Engineer Office.
5412 A

WANTED IMMEDIATELY, THREE Energetic YOUNG MEN, age about 26, good education and training essential, to Assist in Works Production in an Engineering Shop in the Midlands.—Address, 5352, The Engineer Office. 5352 A

ASSISTANT CIVIL ENGINEER WANTED, Accustomed to Setting Out and Levelling for Railways and Roads measuring and costing.—Reply by letter only, with particulars of training and experience, stating age and salary required, to SIR ROBERT McALPINE and SONS, 50, Pall Mall.
5407 A

CONSTRUCTIONAL STEEL WORK DESIGNER REQUIRED for London Consulting Engineer's Office, conversant with L.C.C. 1909 Building Act.

State experience and salary expected.

Address,
P76, The Engineer Office. P76 A

JUNIOR HEATING ENGINEER.—BOULTON and PAUL, Ltd., Norwich, have a VACANCY for a JUNIOR HEATING ENGINEER on their staff. Must have good qualifications for theoretical work and have had some practical experience. Age 20-24.—Write qualifications to BOULTON and PAUL, Ltd. (Reference G.E.F.), Norwich. 5410 A

PLANNING ENGINEER REQUIRED for Large Automobile Works in Birmingham. Applicant must be fully experienced in either Sheet Metal or Machine Shop Work.—Address, 5340, The Engineer Office. 5340 A

PUBLIC WORKS CONTRACTORS REQUIRE SERVICES of young ENGINEER for Setting Out. Must be accurate instrument man. Applications in writing, giving full particulars of experience, age, and salary required.—Address, 5432, The Engineer Office. 5432 A

RATEFIXER REQUIRED for Motor Car Works in Birmingham; man preferred who has been in charge and used to Time Study Methods.—Address, 5341, The Engineer Office. 5341 A

REINFORCED CONCRETE DESIGNER REQUIRED IMMEDIATELY, capable of designing and detailing.—Apply, stating age, experience, and salary required, to MITCHELL CONVEYOR CO., 45-50, Holborn-viaduct. P87 A

WORKS MANAGER REQUIRED for Modern General Engineering Works in Wolverhampton district. State age, experience, and salary required.—Address, 5402, The Engineer Office. 5402 A

WANTED, MARINE ENGINE DRAUGHTSMEN, accustomed to Pipe Arrangement and Detail Work. Age 25 to 35.—Apply, stating age, experience, and salary required, to "MARINE," Wm. Porteous and Co., Advertising Agents, Glasgow. P74 A

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SITUATIONS OPEN (continued)

DRAUGHTSMAN DESIGNER for Industrial Heat Treatment Furnaces and Ovens. Must be first-class mechanical draughtsman, with good knowledge of Heat and Electricity and able to get out schemes and estimates. State age, full particulars and salary required.—Address, 5427, The Engineer Office. 5427 A

DRAUGHTSMAN.—WANTED, SENIOR MAN with considerable experience as Jig, Tool and General Mechanical Engineering Designer, by large firm manufacturing high-class Automatic Machines, situated 20 miles from London.—Address, stating age, experience and salary required, 5388, The Engineer Office. 5388 A

EXPERIENCED DRAUGHTSMAN WANTED, with sound knowledge and experience in design and construction of Public Wash-house and Laundry Plant. Permanent progressive position.—Address, with full details as to experience, salary required, when at liberty, 5425, The Engineer Office. 5425 A

THE CHATWOOD SAFE CO., Ltd., Bankers' Engineers, Shrewsbury, invite APPLICATIONS from capable and experienced DRAUGHTSMEN with sound mechanical training.

Particulars of experience, age, and salary required should be addressed to the TECHNICAL DIRECTOR. 5403 A

TWO TEMPORARY ENGINEERING ASSISTANTS REQUIRED for London. Should have good experience in General Civil Engineering and particularly in Bridge Construction. Salary from £6 to £8 a week, according to experience.

Write, stating age, experience, &c., to Box 184, Anderson's Advertising Agency, 14, King William-street, W.C. 2. 5413 A

WANTED, MACHINE SHOP FOREMAN, Used to latest methods of accurate production on Lathes, Boring and Milling Machines, Grinders, &c., with some knowledge of the Design of Tools and Jigs. N.E.C. State experience, age, and salary required.—Address, 5437, The Engineer Office. 5437 A

SITUATIONS WANTED

A FULLY qualified COMMERCIAL ENGINEER DESIRES a POSITION as LONDON REPRESENTATIVE with or without office facilities and services. Has a good connection and is greatly experienced in Pumps and Installations, Oil and Gas Engines, Steam Engines and Boilers and general engineering. Salary and Commission.

Address, 5433, The Engineer Office. 5433 B

ADVERTISER SEEKS POST; Exp. Gen. Eng., automobile, railway, constructional works and contractors, home and abroad. Wide exp. in responsible positions. Disengaged Aug. 1st.—Address, P7167, The Engineer Office. P7167 B

BOILER SHOP WORK.—DRAUGHTSMAN, Capable charge hand, SEEKS CHANGE. Expd. in marine and water-tube boilers, also light and heavy platers' work of all kinds.—Address, P70, The Engineer Office. P70 B

CENTRIFUGAL PUMPS.—CHIEF ENGINEER and DESIGNER, with extensive experience in all types of high and low-lift centrifugal pumps, DESIRES CHANGE; reasonable salary.—Address, P38, The Engineer Office. P38 B

SITUATIONS WANTED (continued)

CYLINDER LINERS.—PRODUCTION ENGINEER, thoroughly conversant with the production of above, WISHES to GET into COMMUNICATION with LARGE FOUNDRIES or interested BUSINESS MEN. DESIRES to EQUIP and CONTROL MODERN PLANT.—V. C. RANFORD, 55, Clynton-lane, Kenilworth. P77 B

COST, STORES AND PROGRESS RECORDS.—ENGINEER SPECIALIST WANTS POST with large Manufacturing Firm, London District preferred. University education. Twenty years' works and commercial experience.—Address, P81, The Engineer Office. P81 B

DOES YOUR BUSINESS REQUIRE A DEVELOPMENT ENGINEER?—Are you looking for an experienced high-grade technical man with an extensive knowledge of world conditions? One who knows what others are doing at home and abroad. Can take a new idea through the experimental stages to Success and make real profits. Advertiser has had 5 years' of this class of work, backed by 17 years of practical experience, highest technical and University qualifications. YOU WANT—"RESULTS, not EXCUSES."

Write Box C. 987, Willings, 86, Strand, W.C. 2
5404 B

DRAUGHTSMAN (35) DESIRES POSITION. Long experience chemical plant, tank storage and pipe work all descriptions; design, estimates, sales.—Address, P88, The Engineer Office. P88 B

DRAUGHTSMAN (Senior), Experienced in Structural steel, elevating and conveying plant, DESIRES POST.
Address, P75, The Engineer Office. P75 B

ENGINEER (Mech.), with Some Years' successful managerial experience, engineering works, textile factories, with high executive and business abilities, sales organiser, who has in the past put a money-losing undertaking on to a profit-earning basis, REQUIRES OPENING, home or abroad. No proposition too difficult to be tackled.
Address, P79, The Engineer Office. P79 B

ENGINEERING DRAUGHTSMAN (34), A.M.T.I. (Gt. Bt.), SEEKS ENGAGEMENT as Representative or other responsible position. 17½ years in mechanical and constructional steelwork and plant designer; well known amongst contractors' engineers; very active and ambitious.—Address, P85, The Engineer Office. P85 B

PRACTICAL ENGINEER, with Exceptionally wide technical, commercial and administrative experience in Great Britain, Continental Europe, India, Egypt, and elsewhere, SEEKS RESPONSIBLE POSITION with first-class firm desirous developing Export Trade.

Salary is not the immediate object, if facilities are afforded to support an aggressive policy, with guaranteed participation in profits.

Would consider appointment in Asia or Africa on similar lines. Age 40.
Address, P43, The Engineer Office. P43 B

SOUTH AMERICA.—ENGINEER SEEKS OPENING in Administrative or Executive Position. Successful career in connection railways, transport, industrial, and commercial undertakings as Chief Engineer, General Manager. Unlimited energy and initiative, first-class credentials; speaks Spanish, Portuguese.
Address, P78, The Engineer Office. P78 B

WORKS MANAGER POSITION REQUIRED, thorough, good organiser; air receivers, oil tanks, &c., oxy-acetylene and electric welding; in business at present, but giving up.—Address, P71, The Engineer Office. P71 B

SITUATIONS WANTED (continued)

LADY SHORTHAND-TYPIST DESIRES SECRETARIAL POST. 20 years' experience, mostly engineering. Speeds 120/60 w.p.m. certificated. First-class references. Salary 75s.—Address, P84, The Engineer Office. P84 B

YOUNG MAN (21½), Commercial Education, Good knowledge French and Italian, London Matriculation, mechanical and marine engineering certificates, one year varied experience at H.M. Dockyard, Malta, SEEKS OPENING.
Address, P90, The Engineer Office. P90 B

YOUNG MAN (20½) SEEKS OPENING as Draughtsman; 7 yrs. (sessions) tech. evening sch.; training in draughtsmanship and designing; 4 yrs.' gen. eng. shop apprenticeship; 4 U.E.I. exams. (maths., m/c drawing, eng. sc.). Highest refs. Specimen of work sent on request. Free Aug. 16th.—Address, FISHER, 62, Mt. Pleasant-road, Hastings. P86 B

PARTNERSHIPS

ANY Genuine Business Hampered Through insufficient capital can be ASSISTED in the formation of a Private Limited Liability Company. Sound propositions also entertained.—Write or 'phone Holborn 5048, RAY and RUSSELL, 88, Chancery-lane, London, W.C. 2. P80 C

WILL INVEST £1000. A COMMERCIAL ENGINEER WISHES TO JOIN THE BOARD OF A COMPANY MANUFACTURING LIGHT ENGINEERING SPECIALITIES. HE POSSESSES A LONDON OFFICE HAVING A VERY GOOD ADDRESS, A GOOD SELLING ITEM, AN EXCELLENT SELLING ORGANISATION AND A LARGE PERSONAL CONNECTION. A SHORT TRIAL PERIOD REQUIRED. PRINCIPALS ONLY DEALT WITH.

Address, 5434, The Engineer Office.
5434 C

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Mr. Trevor W. Phillips,

B.Sc., Honours, Engineering, London University, Assoc. M. Inst. C.E., A.M.I. Struct. E., M.R.S.I., F.R.S.A., Chartered Civil Engineer, &c.

For full particulars and advice apply to:—36, DALE-STREET, LIVERPOOL (Tel., Bank 1118). LONDON OFFICE: 65, CHANCERY-LANE, W.C. 2. Ex.

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For continuation of Small Advertisements see page 4.

A Seven-Day Journal

Steel-Framed Buildings.

ON Monday evening, Sir Robert Horne presided over a meeting at the House of Commons of Members of Parliament who are in touch with the country's steel industry. Addressing the meeting, Sir Frank Baines urged the necessity for the adoption of a national code of building regulations. Some of the regulations at present in force were, he said, obsolete, and were acting to restrict the amount of steel used in building construction. He suggested that a central authority should be set up to study new methods of steel construction and their incorporation in a national code. The meeting decided that a deputation representing all parties should wait on the Minister of Health with the object of requesting him to bring the regulations of local authorities up to date. Before the deputation waits on the Minister consultations are to take place between the different organisations, industries and authorities concerned with the use of steel in building construction with a view to the drawing up of a standard code of regulations for presentation to the Minister. The meeting appointed an executive committee consisting of Sir Robert Horne (Chairman), Mr. John Baker, Major Colville, Mr. Clement Davies, Major Beaumont Thomas, and Mr. James Walker.

Broadcasting House.

RAPID progress is being made with the erection of the B.B.C.'s new headquarters in Portland-place, London. During last autumn and winter the excavation work was completed, the foundations were laid, and the retaining wall enclosing the three floors below ground level was erected. It is stated that subsoil water was encountered to an extent which introduced a pressure at the foot of the retaining wall of more than half a ton to the square foot. Another difficulty met with and surmounted was provided by the great London sewer, which runs diagonally beneath the site. This sewer, of brickwork and over a hundred years old, is incapable of taking any superimposed load. Before the foundations could be laid or the retaining wall erected it had to be encased in a sheath of reinforced concrete. The work of erecting the superstructure of the building was begun in February. The outer steel work frame is now well advanced and a quantity of the exterior Portland stone has been fixed in position. Many thousands of square feet of concrete flooring have already been laid and the central brick tower to contain the studios and their attached suites is beginning to take shape. Two studios below the ground level have been completed in the rough. In the sanitary arrangements planned for the building what is claimed to be, so far as London is concerned, a novel system of mechanical air extraction will be embodied. The central tower will be dependent entirely on artificial illumination. "Artificial daylight" introduced through casement windows of a normal type is to be employed. The scheme of ventilation for the building is stated to be the most complicated of its kind ever undertaken in view of the onerous conditions as regards silence, temperature and humidity which have to be observed. Two hundred tons of steel ducts will be used in connection with it. As we have previously stated, the architect of the building is Lieut.-Col. G. Val Myer, with whom is associated Mr. M. T. Tudsberry, the Corporation's civil engineer.

The Unemployment Problem.

ACCORDING to the Ministry of Labour's weekly returns, there were on July 7th 1,933,500 persons registered as unemployed at the Labour Exchanges. This figure represents an increase of 42,925 during the week and is 789,254 greater than the figure for the corresponding week last year. Not since the summer of 1921, during the national coal strike, has the unemployment figure exceeded 1,900,000. Simultaneously with the publication of these figures the announcement was made that the Unemployment Grants Committee had approved a further batch of schemes designed for the relief of unemployment. The estimated cost of these schemes is £1,002,000. They will provide employment, it is calculated, for 2000 men. At that rate, something like £1,000,000,000 would be required to eradicate unemployment from our midst. That figure is just about equal to half the total annual income of the taxpayers of this country.

The Schneider Trophy Contest, 1931.

DIFFICULTIES are gathering thickly about next year's Schneider Trophy contest. First, the British Government announced that it would take no further official part in the contest and that it would leave to private enterprise the formidable task of providing entries and training the pilots. Then the Admiralty placed a ban on the use of the Solent as the course for the contest on the ground of the delay and interference to shipping which, as judged by last year's experience, would thereby be caused. Now comes the news that the Royal Aero Club, on which falls the duty of organising the contest, has declined to accept the entry submitted by the Italian Royal Aero Club and has returned the fees for three aircraft which the Italians desired to enter for the contest. The ground for the British club's action is, no doubt, strictly just, but it hardly appears such as to prevent an amicable arrangement being reached. The Club, in agreement with the Fédération Aeronautique International, last January published, as it was required and had authority to do, the conditions under which the contest would be held. Subsequently, the International Federation changed some of the details of one of the articles governing the contest, namely, an article affecting the guarantee fee and designed to prevent frivolous entries. The Italian entries were submitted in conformity with the modified regulations. The Royal Aero Club contends that the modifications were made illegally and that those published in January must stand. There is no suggestion that the Italian entries are frivolous. The British attitude involves a matter of principle. It is argued that the date in January on which the original conditions were published marks the official start of preparations for the contest, and that to admit the International Federation's modifications would be to open the door to the possibility of farther modifications. Competitors beginning their preparations now would, as a consequence, have no guarantee that before the date of the contest the conditions would not be altered to an extent that might destroy the value of their preparatory work. It is reported that last year's British machines in the hands of the High Speed Experimental Flight at Felixstowe have, after certain improvements, shown themselves capable of reaching speeds of about 360 miles per hour, or over 30 miles per hour more than the winning speed of last September. So far, it is stated, the Air Ministry has received no request from private sources for the loan of these machines for next year's contest.

Empire Possibilities.

SPEAKING at the annual general meeting of Petters, Ltd., Sir Ernest Petter said that the British Empire offered the best hope for the improvement of our industrial situation and the removal of the curse of unemployment, with its attendant evils that has so long affected the country, and which had become greatly accentuated during recent months. At last the nation was awakening to a realisation that the welfare of its industries and agriculture could no longer be made the shuttlecock of political opportunism or that those engaged in them could be left to fight a losing battle against the dumping of foreign manufactures and products, produced in countries which did not enjoy the standard of living attained in Great Britain. The ability and willingness of the Empire to assist the country in solving its post-war problems had too long been ignored, and whilst markets which had previously been open to British firms had been closing against them, no steps had been taken to apply the remedy available. The country preferred to live in insular indifference to the wealth that might be acquired and endeavoured to meet its terrific burdens without availing itself of the assistance offered by its fellow-citizens of the Empire. American prosperity was envied, and missions were sent to investigate its cause, but the real lesson that country taught us seemed to have been missed. A people possessing great territories, comprising every variety of climate and producing almost every commodity necessary to civilisation, could, if it set itself to utilise its resources, become a great independent entity. It was in the welding of the Empire into a homogeneous economic entity that the solution to the present problems in England would ultimately be found.

Marconi's Wireless Telegraph Company.

THE thirty-second ordinary general meeting of Marconi's Wireless Telegraph Company, Ltd., was held at the Connaught Rooms on Monday last, when the Right Hon. Lord Inverforth, chairman of the company, presided. The activities in the research department, Lord Inverforth explained, had necessitated an appreciable increase in the staff, and new ground had been broken in various directions. Many refinements and improvements had been made in beam telegraphy, and while any one of them might not appear of material importance, the aggregate had increased the efficiency of operation considerably. In the field of wireless telephony, the research staff had also made rapid strides. A short-wave telephone system had been installed between Rome and Sardinia under a guarantee of service equal to that of a metallic circuit, and the tests that had already been made showed that the scheme was a success. It was the first commercial service to be worked in the ultra-short-wave region, where the propagation was not aided by rays bent down from the upper atmosphere. The introduction of night flying had made the development of an accurate directional aid to aircraft, during darkness, a matter of urgent necessity, and it was satisfactory to be able to state that a special receiving aerial system for use at ground stations, and known as the Marconi-Adcock system, had been devised and successfully demonstrated to representatives of the Air Ministry and Post Office. As the apparatus eliminated the so-called night effect that gave rise to unreliability of bearings during darkness, it was reasonable to suppose that it would hasten the introduction of regular night flights on commercial routes. An outstanding achievement of the research department during the past twelve months had been an investigation of the best possible methods of stabilising the frequencies of transmission stations. While critics sometimes contended that the amount of money spent on research was excessive, the directors of the company did not hold that view. Adequate expenditure on research work was absolutely essential to the continued prosperity, and indeed the existence, of the company.

The German Locomotive Industry.

THE German locomotive industry, it would appear, is in a grave position. A memorial on the subject has recently been addressed to the Government of the Reich by the leading builders, namely, the Henschel, Borsig, Schwartzkopf, Krupp, and Hanomag companies. In the memorial it is asserted that for some years past the orders for engines received from the German State Railway Company have been inadequate and have been given out spasmodically. The manufacturers have endeavoured to keep their workers employed by obtaining orders from abroad, but recently, in spite of the sacrifices in prices which have been made in order to secure business, the volume of foreign orders has fallen off. So great has been the diminution that unless a surprisingly great recovery takes place within the next six months more than 6000 men employed in the locomotive industry will, it is asserted, have to be dismissed. The manufacturers suggest that the German State Railway Company should be urged to place an immediate and special order for the construction of several hundred engines. The situation is illuminated by the balance sheet for 1929 just published by Henschel und Sohn, of Cassel. This company has a capital of 45 million marks, the bulk of which is held by the Henschel family and the remainder by the Maffei family. The year closed with a loss of 2,044,000 marks. This loss is to be covered by drawing on the reserve fund, which stands at 4,500,000 marks. In the balance sheet 2,702,000 marks are set against depreciation, 1,620,000 marks against income tax, and 2,330,000 against insurance and other social service burdens.

Electricity in South-West Midlands.

ACCORDING to the annual report of the South-West Midlands Advisory Joint Committee, which was the first of such bodies to be established under the Electricity Supply Act, 1919, there was considerable progress during the year ending March 31st last. Additions to generating plant represented 78,387 kilowatts. One hundred and seventy-six miles of extra high-tension mains and 273 miles of distributors were put into operation. The increase in the maximum simultaneous load on feeders as compared with the previous year was 11 per cent., and in connections to mains 13½ per cent., whilst the increase in the number of consumers was no less than 20·3 per cent. The total quantity of electricity sold throughout the district increased by 13·4 per cent., whilst the consumption per head of population showed an advance from 228 to 255 units. Satisfactory advances were also made in the matter of dealing with undeveloped rural areas, supplies having been made available for the first time in a considerable number of small townships and villages, including Sheldon, Monkspath, Solihull Lodge, Hollywood, Broome, Knightwick, Shelsey Beauchamp, Harvington, Norton, Ribblesford, Blakedown, Trimpley, Dunsley, Seven Stoke, Bredon, and Martley.

A New System of Ship Construction.

AT a meeting of the Society of Consulting Marine Engineers and Ship Surveyors, which was held on Monday evening, July 14th, at Liverpool, Mr. H. E. J. Camps, a past-president of the Society, gave an interesting description of a patented diagonal framing system of ship construction which he has recently evolved. After outlining the accepted principles recognised in the structure of a ship, the author pointed out that diagonally or obliquely arranged frames, while performing all the functions of vertical frames, also acted as ties and prevented longitudinal distortions of the upper and lower flanges of the girder under hogging or sagging conditions. The absence of complete vertical lines of rivet holes through the sides of the ship also materially increased the value of the side plating for strength purposes. A wider spacing of transverse beams and floors was also made possible, and the diagonal system of framing also assisted the decks and double bottom to resist stress. The system adopted was closely allied to that used in bridge construction, and gave the lightest form of structure combined with the maximum resistance to stress, as in the lattice or warren type of girder. Compared with the transverse system of framing, the author claimed that the diagonal framing system gave a much stronger ship weight for weight for modern scantlings, especially for ships having a length of about 400ft.

Links in the History of the Locomotive.

By C. F. DENDY MARSHALL, M.A., M.I. Loco. E.

SINCE the publication of my "Two Essays in Early Locomotive History" in 1928, various further evidence has come to light, some of it relating to engines not previously known. At present some are not much more than ghosts rising from the past; but I am publishing the information in the hope that more may be forthcoming, and that by the time a second edition is called for, a more definite and accurate history of the first hundred engines will be possible.

TREVITHICK.

The date of the first trial of the Welsh engine was misprinted February 13th; it should be 11th. Comment was made on the neglect of Trevithick in Farey's "Treatise on the Steam Engine." It now appears that the latter intended to publish a second volume, a considerable part of which exists in proof form at the Patent Office Library. It would be a fine "gesture" if someone would undertake the cost of publishing this book.

It gives a description of the Merthyr Tydvil locomotive, saying that the boiler was 4¼ft. diameter by 8ft. long—the diameter was not much exceeded for eighty or ninety years—the steam cylinder was within the boiler, 8in. diameter, 4½ft. stroke. Unfortunately, it is silent on the important point as to whether it was horizontal or vertical; but a footnote later on, relating to locomotives, speaks of "the first arrangement of Mr. Trevithick's high-pressure engine with the cylinder placed horizontally," which is fairly conclusive. Alongside the description of the engine there is a manuscript note saying "See Farey, Sketches III., 414, for drawing of a model of this engine." It is much to be feared that the sketches referred to no longer exist; I have been unable to find any trace of them.

BLENKINSOP.

Considerable further light has been thrown on the activities of this pioneer by Mr. E. A. Forward's articles in THE ENGINEER of January 24th and 31st, 1930, which contain a number of previously unpublished letters on the subject, some being from Blenkinsop himself. Following the usual tradition, I stated that the Kenton and Coxlodge engines only worked till May, 1815. There is good evidence that they were laid aside then; but it appears that they were brought into use again later on. In the "Histoire des Premiers Chemins de fer Français," by L.-J. Gras (1924), on page 11, a report by the French engineer de Gallois, of a visit of inspection to England, lasting six months, is quoted from the "Annales des Mines," 1818, in which it is stated that there were three railways in the neighbourhood of Newcastle on which locomotives were in use. The exact date of his visit cannot be determined, but it was after the Hundred Days; therefore between June, 1815, and probably 1817 at latest. Two of the railways were, of course, Wylam and Killingworth, but what could the third have been, except Kenton and Coxlodge?

Mr. Forward has discovered that John Watson, who was interested in the latter colliery, claimed £2100 from his partner, Samuel Williams, as his "loss by laying off the travelling engines from May 1815 to Lady Day 1817." Hence de Gallois' visit was probably after March in the latter year.

Evidence has come to light of three more of Blenkinsop's engines, at Orrell Colliery, Wigan. The minutes of the Liverpool and Manchester Railway Bill of 1825 show that the line was quite a short one, running from the colliery down to the "Sankey Navigation;" this line it was proposed to intersect.

In the "Repertory of Arts, Manufactures and Agriculture," second series, Vol. XXXIII., 1818, on page 19, we find:—

"Mr. Blenkinsop's Answers to Sir John Sinclair's Queries respecting the conveyance of coals on Railways by Steam Engines."

"*Query* 1.—By whom were they first tried or invented?

"*Ans.*—By Mr. Blenkinsop, who had a patent granted in April, 1811.

"*Query* 2.—How long have they been in use, and at what works?

"*Ans.*—At Middleton Colliery near Leeds, belonging to Charles John Brandling Esq. since June 1812; also at Wellington Colliery, John Waston Esq.; at Orrell Colliery near Wigan, Lancs.; Kenton and Coxlodge Collieries, near Newcastle, Northumberland.

"*Query* 3.—What is the original expense?

"*Ans.*—The steam carriage with two 8 inch cylinders will cost £400, . . . will draw 100 tons; 10 miles an hour lightly loaded, full load, 2½."

"Wellington Colliery, John Waston," undoubtedly means "Willington Colliery, John Watson," as this is the address of some of the letters quoted by Mr. Forward.

Then follows a kind of commentary on, and expansion of, Blenkinsop's replies. It is headed "Mr. Blenkinsop's Answers," and signed "J.B." (Newcastle). Mr. Forward thinks it is not by the same hand, and suggests John Buddle, which seems very likely. He mentions Chapman's bogie, but as he does not say it had been used, it is increasingly probable that it had not. He describes the "chain patent," and says it has been "effectively proved under very disadvantageous circumstances on the wooden rail way from Heaton Colliery to the River Tyne."

From a memorandum of 1813 given by Mr. Forward, it appears that "the Kenton way joins Willington Waggon way." The Willington engines, therefore, were probably the same as those of the Kenton and Coxlodge ones, worked more or less in common. The curious combination of names "Lord Wellington" and "Marquis Wellington," supposed to be two of the Leeds engines, seems to have arisen from the fact that one of them was called "Willington," after the colliery. It was lent to Kenton for a time, and then returned to Leeds.

We now come to Orrell. Here we have clearly three fresh engines. In "Newton's London Journal of Arts and Sciences," 1st series, Vol. III. (1822), on page 196 there is a letter to the editor, signed "W. Simmons, Wigan, 16th March 1822," as follows:—

"At Orrell there is a loco-motive steam-engine on a rack railroad that regularly draws 9 wagons of coal at once at the rate of 2½ miles an hour. . . . On the aforesaid railroad there are two locomotives in constant action: but it is found absolutely necessary to have three, one being kept in repair to supply the place of the other two, when one of them becomes unfit for action; which sometimes takes place, principally from the lightness and consequent weakness of the engines' boilers."

The *Wigan Examiner* for May 3rd, 1930, contains some valuable information on the subject of the Orrell engines, taken from "The Kaleidoscope, or Literary and Scientific Mirror" for 1822. In the number for September 24th, there was an article reprinted from the *Liverpool Mercury* of July 3rd, 1812, on the subject of the Middleton engines, followed by a paragraph describing an engine at Orrell, which is called the "Walking Horse." In the issue for October 8th there appeared a letter from no less an authority than Benjamin Hick, dated "Union Foundry, Bolton, September 30th 1822," in which he definitely states that there are three travelling engines at Orrell Colliery, near Wigan, two of which had been regularly at work for upwards of 8 years. The pressure was 32 pounds per square inch. Each engine has two cylinders, eight inches in diameter, with metallic pistons that require no packing . . . cranks . . . . at right angles . . . . cogs on one side of the railway.

A broadsheet, published by Bethell, of Liverpool, at the time of the opening of the Liverpool and Manchester Railway in 1830, a copy of which is in the Liverpool Public Library, mentions a railway at Orrell, near Wigan, on which six or seven wagons of coal were drawn by a steam engine, thus saving the expense and upkeep of five horses at the least. It is, however, possible that a stationary engine is being alluded to; at all events it does not use the word locomotive.

There is a reference to an engine here in the "History of Coalmining in Great Britain," by R. J. Galloway (1882), on page 191:—"About 1813 a Blenkinsop locomotive was placed on the railway at Orrell Colliery, Wigan; and from a letter of Blenkinsop's dated 26th March 1814 we learn that the engines at Leeds, Newcastle and Wigan were all 'giving the greatest satisfaction,' and were performing their work at one sixth the cost of horses."

George Stephenson, when giving evidence before the Liverpool and Manchester Railway Parliamentary Committee in 1825, said he had seen locomotives at work at Wigan and Leeds. Mr. Orrell strenuously opposed the L. and M. Railway, and his property and mines were elaborately described and discussed, but nothing whatever is said about his having had locomotives of his own, so we must assume that they had been given up by 1825, otherwise the fact would have been bound to come out. As it is, it is most astonishing that neither his counsel nor those on the side of the railway tried to make any capital out of the fact—which it undoubtedly was—that locomotives had been used at his own colliery; especially in view of George Stephenson's knowledge of them, which had been brought to light earlier in the proceedings. In all the thirty-two pages of evidence dealing with Orrell's case against the railway, there is not a suspicion of a reference to them. In the course of summing up, his counsel said: "There is a coal-pit. . . . Is that any reason why they should bring the smoking chimneys of locomotives and establish a permanent nuisance, passing between 1 or 200 yards from his door?"

It is true that his own railway was farther away, being at the nearest point nearly 600 yards from the house.

I have received the following reply to a request for information from the Orrell Colliery Company, dated October 22nd, 1929:

"We have made inquiries, and think the loco. referred to is what is known as the 'Yorkshire Horse,' but sorry we are unable at the moment to furnish details."

WHITEHAVEN COLLIERIES.

This is a fresh line of investigation, of great interest, but at present rather cloudy. A new William Stewart has emerged from the shades, namely Taylor Swainson.

I have found several references on the subject of locomotives at Whitehaven; possibly all relating to the same one, though it appears as if trials took place both in 1812 and 1817. Taken together, they certainly establish the fact of at least one essay in steam locomotion having been made here; on the principle that there are no products of combustion without burning.

The earliest reference occurs in the report of de Gallois' visit to England about 1817, to which allusion has already been made. After speaking of the locomotives at Newcastle, he goes on to say that he saw several at Leeds, and that they were going to establish one at "Witehaven," where these chariots would promenade underground! adding that the workmen call these machines "Iron Horses." The mention of this nickname in the same breath as Whitehaven is very significant, as it crops up in nearly every reference thereto.

In a "Historical Sketch of the Whitehaven Collieries," by R. W. Moore—"Transactions of the Federated Institute of Mining Engineers," Vol. VII., 1893–94—on page 632 the following passage occurs:

"In 1812 Mr. Taylor Swainson, engineer for the Whitehaven Collieries, tried his invention of the 'iron horse,' or locomotive engine, on the colliery waggon roads. The engine answered admirably, but its use had to be discontinued owing to the track not being strong enough to bear it. It has been said that Mr. Taylor Swainson was the real inventor of the locomotive."

This engine is too early for de Gallois' reference. Evidence of a second attempt, which would correspond with it, appears in a paper on the "Archæology of the West Cumberland Coal Trade," which was read by Isaac Fletcher, M.P., F.R.S., in December, 1877, before the Cumberland and Westmoreland Antiquarian and Archæological Society, and included in their "Transactions," Old Series, Vol. III., 1876–7. On page 308 he says:—

"In 1816 a locomotive was purchased by Mr. Buddle at Newcastle, and used for some time on the Howgill railways; but they being of cast iron were inadequate to sustain the weight of the engine, and its use in consequence was discontinued. Some portions of the engine are still in being."

Who could have built this engine? It cannot be traced as one of Stephenson's, but it may have been.

In Galloway's "History of Coalmining," John Buddle is said to have become manager at Wallsend in 1806.

In the *Whitehaven News* for August 22nd, 1929, two letters appeared on the subject of Swainson's engine—probably as a result of my stirring up the subject. One, from Mr. T. S. Durham, Mineral Agent to Lord Lonsdale, stated: "The Earl of Lonsdale's records show that the 'Iron Horse' made by Mr. Taylor Swainson, who was the engineer to the Whitehaven Collieries, was tried in the year 1812. The engine worked very well, but the track was not strong enough for use with it."

Here we have an almost literal confirmation, based on the old records, of R. W. Moore's story of 1893, quoted above.

The second letter contains the following information:—

"The Whitehaven Colliery has produced some remarkable men, none perhaps more so than the late Mr. Taylor Swainson, for whom, it will be seen by the following extract from a diary kept by the late Mr. Noble Steele, a Whitehaven printer (who served his apprenticeship at the *Pacquet* office, where his father was foreman), the invention of the locomotive steam engine is claimed:—

'When I was quite a child about the year 1812 a locomotive engine was running in Whitehaven. It was called the "Iron Horse," and was used for drawing wagons from the pits towards the harbour, and was invented and built by Mr. Taylor Swainson, engineer to the Earl of Lonsdale, one of whose sons was afterwards a school-fellow of mine. . . .

'Mr. Swainson took a holiday. Mr. John Peile, the Earl of Lonsdale's colliery agent, being anxious to see the "Iron Horse" at work, sent to Newcastle and succeeded in engaging one of the first engineers with which that part of the country could furnish him, to endeavour to set the wonderful machine in motion. The great man came, and after a vast amount of study and labour, he was obliged to admit that it was beyond his power; and there the ingenious contrivance stood still, awaiting the return to usefulness and activity of Taylor. At length the inventor was himself again, and the "Iron Horse" was in less than a week set to motion to the wonder and admiration of congregated thousands.

'The reason why its use was discontinued was on account of the rails in those days being made of cast iron, or what was technically known as pot metal, which was found to be quite unable to bear the heavy weight and friction of the ponderous machine."

"Mr. Thomas Taylor Swainson, of Moor Row, is a great-grandchild of Mr. Taylor Swainson."

This interesting letter is signed "T. T. S.," being, in fact, the gentleman mentioned in the last paragraph. The date of the entry in the diary is not given.

Mr. W. H. Johnson, general manager of the White-

haven Collieries, wrote in answer to inquiries, October 19th, 1929 :—

"I cannot give you a record, but I think it is correct to assume that only one early locomotive was built and used at Whitehaven about the year 1812. This was the locomotive built by Mr. Taylor Swainson, who was the mechanical engineer for the collieries at that time. It is said that it was his own invention entirely, and that is probably true, as he seems to have been a very capable man. I never heard of a locomotive being purchased from Newcastle or other place, but I think your notes all refer to one locomotive. 'Howgill' is the name of the colliery area on the south side of Whitehaven, 'Whingill' being the name of that on the north. John Buddle was employed only as a consulting engineer."

In a subsequent letter, Mr. Johnson wrote :—

"There is no record of any locomotive other than that of Swainson's, and I think that the engine referred to in Mr. Fletcher's paper was a pumping engine, probably that of William Pit in the Whingill area."

My own opinion is that de Gallois may have mixed up the stories about the "Iron Horse" of 1812 with some proposal for an underground (stationary) hauling engine. Still, Fletcher's evidence is very circumstantial. It is always possible that some of these collieries may have had an engine sent on approval, as one has a car to try in these days, and returned it to the makers, which would account for some of the engines which cannot be definitely traced.

Gloucester and Cheltenham Railway.

A further notice of the engine which was said to be "formed without a boiler, and consequently without the slightest risk of explosion," has been discovered. My surmise that it might have been a Brown's gas vacuum engine turns out to be wrong. *The Times* quotation given in "Two Essays" was copied from the *Cheltenham Chronicle* of January 13th, 1825. On May 12th the following paragraph appeared :—

"We some weeks ago announced the intention of Mr. B. Newmarch to establish a newly-constructed Locomotive Engine for the purpose of plying between Gloucester and Cheltenham. The necessary arrangements having been completed, we understand that it will start this day (Thursday) from Mr. Newmarch's wharf in Gloucester, and arrive in this town about 2 o'clock.

"As we previously stated, this machine is on a new principle, invented by Major McCardy, and may be considered the first that has been perfected without the danger to be apprehended from explosion, as it is formed without a boiler. We heartily wish all possible success to this spirited undertaking."

Unfortunately, no subsequent reference to the engine can be found; whether it worked, or even whether it was ever finished, we do not know, but there is one very interesting point about the above notice, which explains what was meant by the absence of boiler and risk of explosion, and that is the name McCardy. It is obviously a mistake for M'Curdy, who took out patents for a flash boiler in 1824 and 1825. These inventions are described in Galloway's "History and Progress of the Steam Engine" (1836).

The drawing of the 1824 idea shows a thick iron tube, 11ft. long, shaped like an L lying on its back, tapering down from 6in. at the end of the long arm, where the water was pumped in through a pipe perforated with small holes, to 3in. at the upper end, whence the steam went to the engine.

Galloway also says :—

"This invention originated in America, where great anticipations were entertained of its utility, and it was announced in the public journals of England and Europe generally, not merely as an important discovery in science, but as forming almost an era in the History of the Steam Engine. Mr. M'Curdy brought the invention over to this country, took out a patent, and subsequently sold his patent right for a large sum of money."

It appears that trouble was experienced in the shape of priming.

The 1825 patent was quite different. The whole boiler is shown, containing six horizontal water tubes of considerable size, but with their interior nearly filled up by a kind of iron sausage, which contained air only, so that there was a thin-walled tube of water.

There is rather an interesting reference to this railway in Williams' "History of the Midland Railway," as follows :—

"In laying out the Birmingham and Gloucester line, the promoters resolved to avail themselves of an old tramway that ran from Cheltenham to Gloucester city and docks. It had cost about £50,000, had been in use for mineral and goods traffic for some 30 years, and had been worked at first by horses and subsequently by locomotives built by J. J. Tregelles Price, of Neath Abbey, near Swansea."

Heaton Colliery.

There is no longer any doubt about the existence of a Stephenson locomotive here. I have obtained a copy of the letter referred to by Tomlinson, and mentioned on page 43 of "Two Essays," from Losh to Pease, dated November 3rd, 1821, which is quite conclusive.

Robert Stephenson and Co.

From an old ledger that has recently been found, it appears that the seventeenth engine was booked in 1829 to the Baltimore and Ohio Railway, and did not go, as stated in "Two Essays," to the Boston and Providence, which in fact was not chartered till 1831, and was only opened in 1834. There is no reference to any English engine in Mr. Hungerford's "Story of the Baltimore and Ohio Railroad" (1928).

Major George Washington Whistler, who ordered this engine, was employed on a number of American railways in the early days. In 1842 he went to Russia, and built the line from St. Petersburg to Moscow. He was the father of the celebrated artist, James McNeill Whistler, whose "Life," by E. R. and J. Pennell, contains a good deal of information about him. One of his companions on the trip to England was Jonathan Knight, afterwards engineer to the Baltimore and Ohio Railway.

It is now certain that the "Planet" and "North Star" on the Stockton and Darlington Railway were both of the "Planet" type.

Marc Seguin.

At the time "Two Essays" was written, the available evidence in connection with the dates of Seguin's first engines was not considered quite sufficiently definite to warrant his being credited with more than one among the first hundred. We knew that only one was built at the end of 1829; at which time "three others"—probably a mistake for two others—were in course of construction, but little advanced. About the middle of 1831, it appears from a report of October in that year, there were two, and apparently only two, since a collision between them put an end to experiments.

Monsieur Laurent Seguin has now discovered among Seguin's note-books a report to the directors of the St. Etienne Railway, dated in October, 1830, which states :—

"We have three machines working on the line, but in order not to keep the drivers and firemen waiting, it is only necessary for two to be in active service."

This report establishes the existence of three at the time it was written. Apparently, the third one also happened to be *hors de combat* when the collision took place.

The Tail of the Procession.

The foregoing notes firmly establish seven more early locomotives as having actually existed and worked, namely :—

One by Swainson at Whitehaven, 1812.
Three by Blenkinsop at Orrell, 1813.
One by Stephenson at Heaton.
Two by Seguin, St. Etienne Railway, 1830.

There is also another engine which is earlier in date than some of those given in "Two Essays," namely, the "Warrington," which was the first engine on the Warrington and Newton Railway, built by Robert Stephenson and Co. Rastrick's "Rainhill" notebook says of this engine: "New 1st June 1831." In the recently found ledger to which reference has been made it was booked to the W. and N. Railway on April 16th, at £800.

Eight engines, therefore, have to be discarded from the table in "Two Essays." The reason for not arranging it chronologically was that it was thought more convenient, for purposes of reference, to put the engines in the order in which they were dealt with in the body of the work. The precise dates at which all those after April, 1831, appeared are now given, as nearly as they can be ascertained, the numbers being those of the table.

66.—L. and M.R. "Venus." Between April 18th and May 23rd.

89.—L. and M.R. "Vulcan." Between May 24th and 30th.

67.—L. and M.R. "Etna." Between May 31st and June 20th.

The above dates are shown by the Directors' Minutes.

90.—Monkland and Kirkintilloch. Dodd's first engine. The date of delivery is given as May 10th in Gordon's "Treatise upon Elemental Locomotion" (1834), on page 58.

—.—Warrington and Newton "Warrington." June 1st.

69.—Camden and Amboy "John Bull." Shipped in June (and put to work in November).

100.—Davis and Gartner's "York." June 27th.

Mr. Hungerford, in his "Story of the Baltimore and Ohio Railroad," gives some interesting information about the "American Rainhill." The stipulations, which he quotes in full, were published in the *Baltimore American* of January 4th, 1831. They were obviously modelled on the Liverpool and Manchester ones, but the maximum pressure was fixed at 100 lb. per square inch, instead of 50; there was, however, a hint that a lower pressure would be preferred. The trials are said to have taken place on June 27th, when four engines presented themselves, the "York," "Johnson," "Costeil," and "James," of which only the first one rendered anything like an efficient performance. It began regular work on July 12th.

99.—Mohawk and Hudson "De Witt Clinton." July 2nd.

Brown's "History of the First Locomotives in America" quotes a letter written to him by David Matthew in 1859, thus :—"I left New York with the 'De Witt' on the 25th of June 1831, and had steam to commence running in one week from that time" (*i.e.*, at Charlestown, South Carolina). The date is therefore July 2nd.

97.—Newcastle and Frenchtown, Colonel Long's engine. July 4th.

In "The Locomotive Engine and Philadelphia's Share in its Early Improvements" (revised edition, Philadelphia, 1872), which is an extremely interesting book, we find, on page 25, what is undoubtedly the correct date of the first trial of this engine, which Colburn gave as July 4th, 1832. It was July 4th, 1831; the authority being that of the Hon. W. D. Lewis, who was at that time connected with the N. and F.R.R.

70.—Glasgow and Garnkirk "St. Rollox." July 14th.

71.—Glasgow and Garnkirk "George Stephenson"?

The drawings of the second of these engines are dated May 5th. But this does not necessarily mean that they were completed by then. It was recorded at the time that the "St. Rollox" made its first trip on July 14th, so the "George Stephenson" can certainly go into the "discard."

98.—South Carolina "West Point." July 15th.

A "Report of the Committee on Cars to the Direction of the South Carolina Canal and Railroad Company, submitted to the Stockholders on Wednesday, 20th November, 1833," has been reproduced in Bulletin No. 7 of the Railway and Locomotive Historical Society (1924). It states that the "Best Friend" was received and put to work in December, 1830, and that the "West Point" began work on July 15th, 1831. These dates, of course, are authentic.

68.—Mohawk and Hudson "Robert Fulton." The drawings are dated April, 1831. Colburn says it went out in July, and the *Albany Argus* of August 27th speaks of its having been received. It had therefore better be assigned to July. In "A Century of Locomotive Building" this engine is called "John Bull." It is clear that the original name was "Robert Fulton." But in Clark and Colburn's "Recent Practice in the Locomotive Engine" (1860), it is stated, on page 48, to have been renamed, at first "John Bull," and afterwards "Rochester."

The eight victims which have to be rejected are, working backwards, "Robert Fulton," "West Point," the two Glasgow and Garnkirks, Col. Long, "De Witt Clinton," and "York," (together, of course, with the other three competitive engines mentioned above). and the Camden and Amboy "John Bull."

If Stretton could be trusted, the "Etna" and the newly promoted "Warrington" would have to drop out too. For, in a pamphlet entitled "A History of the Bolton and Leigh Railway," he gives the date of the "Salamander" and "Veteran," supplied to that line by Crook and Dean, of Bolton, as May, 1831, but he does not state his authority.

What is more satisfactory, the same pamphlet contains one or two quotations from contemporary accounts which make it certain that the sketch of the "Union" given on page 71 of "Two Essays," only put forward tentatively, does fairly accurately represent the engine.

It is now settled beyond a doubt that 100 railway engines had been built by June 1st, 1831; of which 93 were British, two German, three French, and two American. A couple of engines by the Neath Abbey Iron Works for Thomas Prothero were mentioned as possible candidates on page 84 of "Two Essays." They have received a definite "leg up" from the following paragraph which appeared in the *South Wales Weekly Argus* for June 14th, 1930. Quoting from the *Monmouthshire Merlin* of June 12th, 1830, it said: "Arrangements have recently been made by the Monmouthshire Canal Company for adapting their extensive lines of tramroad for the use of locomotive engines, which are likely to become general in that district. Mr. Prothero, one of the most extensive coal merchants in that district, intends hauling his coals to Newport with two engines, preparing for him at Neath Abbey Iron Works; and Messrs. Brown, of the Blaina Iron Works, have very nearly completed a locomotive engine for their own use embracing many improvements."

One would like to know if Messrs. Brown's engine ever materialised.

Coming to a later date, mention may be made of an engine which seems to have been lost sight of. In the *Civil Engineer and Architect's Journal* for August, 1840, there is an account of a locomotive tried on the Eastern Counties Railway, constructed by Walter Hancock with a water-tube boiler, chain drive, and clutch, which appears to have been much on the same plan as his road cars. It would be very interesting to know more about it. His "Narrative of Twelve Years' Experiments" was published in 1838, and so does not take it in.

Speaking at the annual summer meeting on Saturday, July 12th, of the Cornish Institute of Engineers, which was devoted to visits of inspection to china clay works, wolfram mines, and slate quarries in North Cornwall, Mr. A. R. Davies, manager of the Rosemellyn China Clay Works, Roche, said a little more co-operation between the china clay industry and the Institute of Engineers would do good, and he added that the time might be opportune very soon for a branch of the Institute to be formed in the china clay district and affiliated to the Institute.

The Britannia Works, Huddersfield.

No. I.

ONE of the branches of the engineering industry that has made great strides in recent years is that concerned with the manufacture of valves and steam fittings. The progress is due in a large measure to the increasing necessity for economy in the use of steam, owing to the higher price of fuel, but perhaps more so to the remarkable developments which are taking place in very high pressures and temperatures. The changes brought about both in the metals employed and the design and construction of valves and fittings necessitated by the causes above mentioned, were vividly brought home to us during a recent visit to the works of Hopkinsons, Ltd., Huddersfield. The foundation of this undertaking was laid as long ago as 1843 in two four-roomed cottages, the backyards of which were utilised for foundry purposes, but the business has made its greatest expansion during the present century. It was in 1903 that the site was acquired on which the present works has been erected. Since that time frequent extensions have been made, until at the present time the buildings cover an area of 11½ acres on a site of 18 acres, and the number of workpeople averages about 1600 normally.

The choice of site appears to have been a happy one. There is a natural gradient from the front to the rear, and advantage has been taken of that fact to bring in the raw materials at the top of the slope and cause them to gravitate, as it were, through the many stages of manufacture until the final products emerge from the loading bay at the bottom of the slope, which is adjacent to a convenient road, whence they are dispatched to all parts by motor vehicle. A plan of the works is given in Fig. 1, and a glance at the lay-out shows that Mr. Robert A. Hopkinson, who was responsible for it, has succeeded in making a symmetrical grouping of the various shops and departments in spite of the difficulties which frequent extensions must have involved. It is not our purpose in this article to give anything like a complete description of the works, but rather to call attention to some of the most impressive features, and to describe somewhat briefly a few of the large number of products which are of special note in the light of modern engineering practice. We must, however, make some reference to the works lay-out generally, and, first, it should be mentioned that all the manufacturing floors are on ground level. In the planning and design of the buildings, the most up-to-date methods have been adopted, both for handling the raw materials and for their ultimate uses. The raw materials and finished products have a separate entrance and exit, as previously indicated, and the work flows almost invariably in one direction. In many cases operations are arranged in line, so as to follow one another with a minimum amount of handling, by the use of roller benches. All the departments are provided with electric trucks, which, together with electric cranes and runways, enable the work to be handled to the best advantage. In the main machine shop, it will be noticed that the tool-room is situated in the middle, thereby giving ready access to it from the various sections devoted to iron, steel, and bronze products respectively.

The administrative buildings are of handsome and substantial design. They cover a large area, and are subdivided into the usual offices for the conduct of the commercial side of the business, counting-house, directors' offices, and rooms for the heads of the various departments. The metallurgical section of the works comprises research and routine laboratories, a test house, and separate foundries for iron, brass, steel, and Platnam—the last mentioned, as many of our readers are aware, being a special, hard, white, non-corrodible alloy which is used very extensively in valve manufacture when high pressures and temperatures are dealt with. The steel foundry is served by an acid-lined, oil-fired Stock converter of 2½ tons capacity. All the cast steel is poured from a stoppered ladle, which is refractory lined, the control of the flow of metal being effected by a special nozzle. Very great precautions are taken to obtain soundness in cast steel valve bodies, and some idea of the care which is taken may be obtained from the yield of castings compared with the weight of steel melted. This, we are informed, is not more than 48 per cent., which, of course, means that more than one-half of the metal is used in the heads and runners. This statement is borne out by reference to the accompanying illustrations of a steel valve body—Fig. 2. The left-hand view shows the casting just as it is taken from the sand, while the right-hand view shows the same casting after it has been treated by the fettler, and the finished product is seen in Fig. 3. Another precaution which is taken to ensure absolute safety with cast steel valves is that of annealing to relieve the casting stresses, particularly at the necks between the flanges and the body. For this purpose the bodies are submitted to a heat of 900 deg. to 925 deg. Cent. for a period of 2½ hours, and are then allowed to cool off gradually. The annealing furnaces are equipped with four two-wire thermo-couples of the platinum-

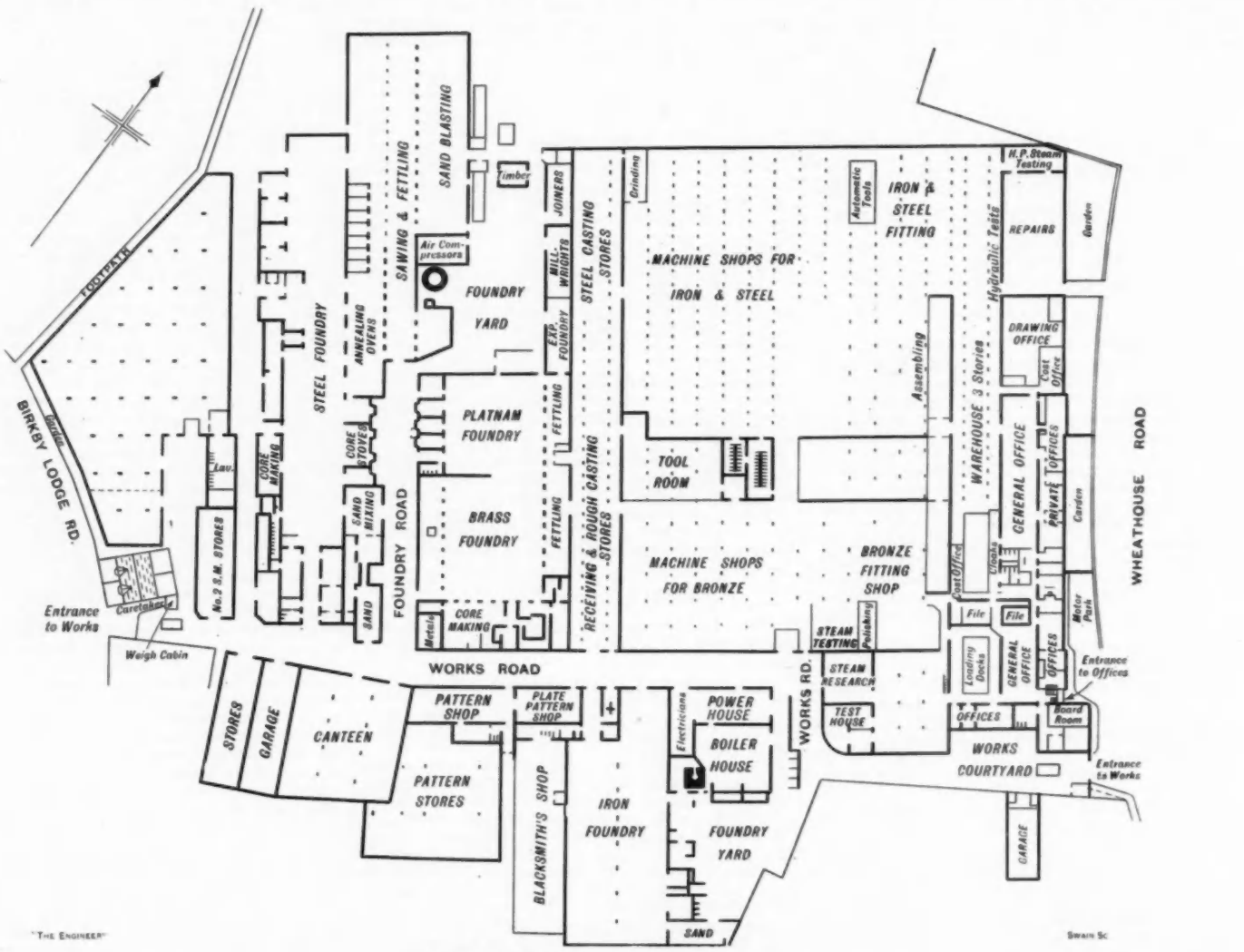


FIG. 1—GENERAL PLAN OF WORKS

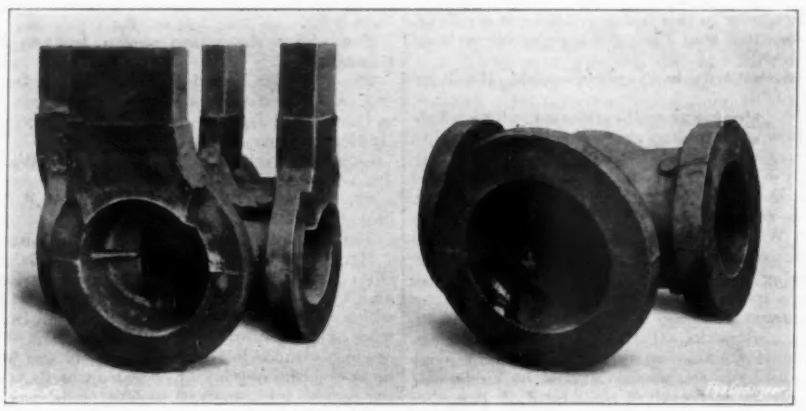


FIG. 2—VALVE BODY WITH AND WITHOUT RUNNERS

rhodium type. The electromotive force generated in these couples passes through the attendant's indicator, and is recorded on a Cambridge instrument in the laboratories. The heads and runners are removed by oxy-acetylene flames, and the electric arc is used to finish off the runners on the body of the valve. The bodies are subsequently treated by a shot blast method.

The steel used has a tensile strength of 28–32 tons per square inch, a yield of 14–16 tons, an elongation of 30 per cent. in 2in., a reduction of area of 40 per cent., an Izod impact test of 20 foot-pounds, a Brinell hardness of between 126–149, and a bending test of 160 deg.

Mention of these items leads up to some brief description of the test-house. This building is equipped with several interesting appliances, including a Buckton 30-ton tensile and bend testing machine, an Avery-Izod impact machine, a Brinell hardness tester, a Vickers diamond testing machine and scleroscope for testing the hardness of Platnam and nitrogen hardened steel and a Foster fatigue testing machine. As further evidence of the care which is taken in the manufacture of steel valves, it may be stated that microstructure photographs are taken of each cast before and after the annealing process. All the shops are characterised by lightness and cleanliness in an unusual degree. Electrical energy is used throughout for driving the machinery and for illumination purposes. The supply of alternating current is purchased from the Huddersfield Corporation at 6500 volts, and is transformed down and converted to direct current at 220 volts. For testing and heating purposes steam is provided by the firm's own boiler plant. There is a works canteen and a well-equipped ambulance room with a masseur and first-aid men in attendance.

The brass foundry contains 48 pit fires, which will shortly be replaced by electric furnaces. The average daily cast amounts to 17 tons, the articles varying in weight from 1 oz. to 1 cwt., and on an average 140,000 castings are produced weekly. The brass cuttings collected from the brass-finishing section are melted down in an oil-fired furnace of 5 cwt. capacity, are cast into ingots and analysed before re-use. Annexes are provided for the storage of coke, and sand-blast appliances are installed for cleaning the castings. In the Platnam foundry there is a Booth direct-arc electric furnace with a capacity of 170 lb. per hour. This furnace, we are informed, is unique in this country at the present moment. The casting temperature is 1600 deg. Cent. Valve seatings are centrifugally cast to provide a close-grained homogeneous metal of greater hardness than is obtained by sand casting. Disc faces, on the other hand, are sand-cast, so as to provide a good bearing surface between the seat and the disc. The metal for steam valve seats and faces should possess the following characteristics:—(1) It should be capable of withstanding the highest steam temperatures without softening or deterioration; (2) it should resist oxidisation at high temperature; (3) it should resist indefinitely the stresses to which it is subjected; (4) it should be proof against erosion and resist the action of ordinary acids; (5) it should possess a good bearing surface, and (6) in the case of mushroom or screw-down type of valve, it should have a high compression strength. It is claimed by the makers that Platnam metal possesses these characteristics, whilst its coefficient of expansion is almost equal to that of steel and its Brinell hardness from 218 to 480. A great deal of attention is paid by the company to the preliminary hydraulic testing of all valve bodies up to 500 lb. per square inch before beginning machining operations. This procedure is also adopted during progress and on completion.

The machine shop covers a very large area and includes fifteen bays, well lighted and ventilated. Space will not permit us to deal with all the multifarious machines which this shop contains, but a brief description of the processes involved in valve manufacture will be of interest. One of the first operations is the planing of the lid flanges. To ensure continuous operation the valve bodies are mounted on long table jigs which are loaded while the machine

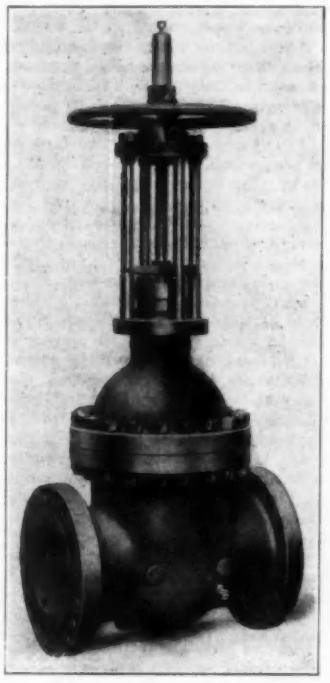


FIG. 3—FINISHED VALVE

is in operation on the preceding batch. As soon as one jig is removed from the machine another takes its place. After planing, the next operation is the boring, after which the valve bodies are tested hydraulically up to 500 lb. pressure. For machining Platnam metal the new cutting material Widia is used, and there is probably no firm in the country which uses Widia more extensively. We shall refer at greater length to the use of this remarkable metal later on.

The next operation in valve manufacture is the pressing-in of the valve seats. It is done with a hydraulic pressure of 2000 lb., and by an ingenious method the seats are firmly secured in the valve bodies. Forged and cast steel valve bodies up to 6in. have three operations completed on one machine, viz., flange-faced, turned and bored. Whilst the machine —Fig. 4—which is of Alfred Herbert's manufacture, is in operation on one valve, the next rough valve body is placed on one arm of the turret. On completion of the operation, the turret is revolved, moved forward and, by means of a self-centring chuck device, the valve body is ready to be machined. The process of drilling the flanges is carried out on some of the latest types of machines, one of which is a B.S.A. multiple driller with a pneumatically operated face-bed. The spindles and pillars are turned between centres and ground and the spindle threads are cut on a thread developing machine, which gives a very accurate pitch, perfect angle of threads and a smooth finish at a remarkably high speed.

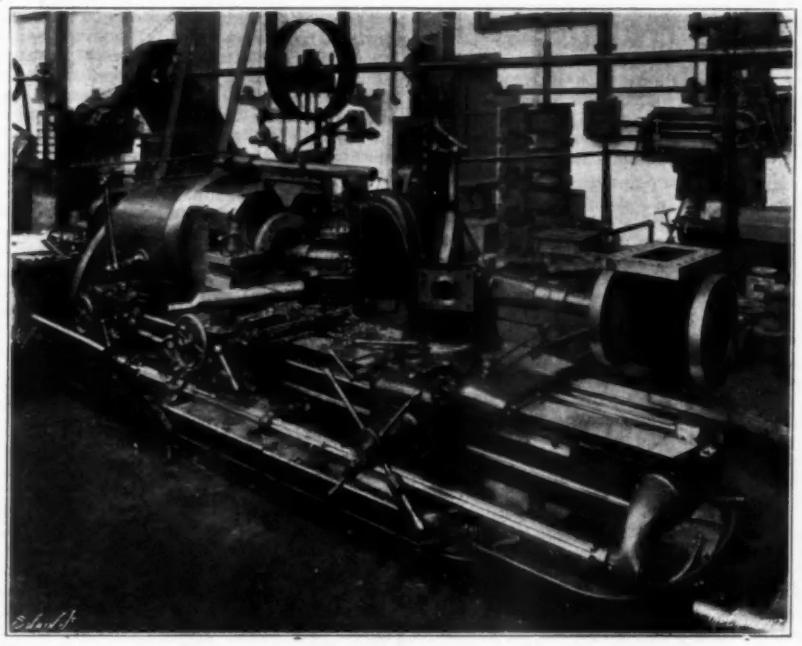


FIG. 4—MACHINING VALVE BODIES

Figs. 5, 6, 7 and 8, on page 66, show a group of interesting machining operations. In Fig. 5 is shown a Town 4ft. radial drilling machine at work on valve flanges. It is set in the middle of two aisles, so that the work can be passed along on each side without crossing. A workman clamps the jobs in position, while the operator performs the drilling. In this way the time occupied between the cuts is reduced to the minimum. Fig. 6 shows an old vertical boring and turning mill converted to electric drive with variable speeds for the effective use of Widia. The large valve on a truck at the machine table level ready for quick clamping without the need of extra help, will be observed. Fig. 7 shows a Lumsden vertical surface grinding machine dealing with steam trap bodies. Fig. 8 shows a Holroyd multiple drilling machine operating on slide valves after these have been ground. A number of steam traps is seen ready for the next operation. A further group of views of the offices and workshops is given in our Supplement.

The company has a very complete system of gauging which ensures accuracy and interchangeability of all machined parts, which are carefully inspected before going forward to the fitting shop. Bronze valve bodies undergo a porosity test before being sent to the machines. This test consists of submerging the valve body whilst under pressure of 80 lb. per square inch in an open tank of water so that any signs of porosity can be detected. Similarly, valve lids are hydraulically tested before assembling. All finished valves are subjected to a final hydraulic test equal to twice the working pressure. There are two steam test-houses, one for iron and steel valves, and the other for bronze valves. During our recent visit, we had an opportunity of inspecting a 10in. cast steel valve which the company has recently constructed for the Detroit-Edison Company, America, to operate with steam at 1000 deg. Fah. Steam for testing was obtained from a Spencer-Bonecourt gas-fired boiler working at 750 lb. pressure and an independent Sugden superheater assisted by an electrical booster made by Hopkinsons.

(To be continued.)

Summer Meeting of the Institution of Naval Architects.

No. I.

AFTER an interval of close upon ten years, the summer meeting of the Institution of Naval Architects was this year again held in Liverpool. The main party left Euston on Monday afternoon, July 14th, and on arrival at Liverpool were joined by the members from the Clyde, Tyne, and North, and from the Liverpool area. In all about 250 members and ladies attended the meeting, which was a most successful one.

On Monday evening there was an informal social evening at the Midland Adelphi Hotel, at which members were received by Sir Frederick Bowring, J.P., a former Lord Mayor of Liverpool, a prominent shipowner, and the Chairman of the Reception Committee. Sir Frederick was assisted by Mrs. Dunn and Mr. W. M. McMenemey, the President of the Liverpool Engineering Society, and Mrs. McMenemey. During the evening Sir Charles Saunders conveyed to the Committee the thanks of the members for the generous hospitality which had been accorded. General regret was felt at the enforced absence of the President, Admiral of the Fleet Lord Wester Wemyss, who, owing to the illness of his daughter, was detained in Paris until Tuesday evening.

Prior to the commencement of the first business session on Tuesday morning, July 15th, in the Council Chamber at the Town Hall, Liverpool, a hearty welcome was extended to the Institution by the Lord Mayor of Liverpool, Councillor Lawrence D. Holt, J.P., on behalf of himself and his brother Mayors of the neighbouring boroughs of Birkenhead, Alderman T. MacLellan; Bootle, Councillor S. Mahon; and Wallasey, Alderman J. G. Storey, and the boroughs they represented. The Lord Mayor was accompanied on the platform by the Mayors of the three boroughs named, and by the Hon. Sir Charles A. Parsons, an Hon. Vice-President of the Institution; Mr. Francis Henderson, the Institution's Treasurer; and other leading officers.

The Lord Mayor said it was indeed fitting that the summer meeting of the Institution should be held in the great port of Liverpool, and it was especially appropriate that the proceedings should be presided over at the outset by Sir Charles Parsons, who held so strong a place in the confidence, respect and affection of all who knew him.

With regard to naval architecture and its allied professions, we were living in an age of remarkable technical achievement. At the same time, we were living in an age of economic gloom. The first line of thought—technical achievement—led one to reflect upon that particular type of achievement which had

built up the greatness of British maritime power and especially the maritime authority of Liverpool, and he would venture to say that the desirable type of technical achievement was thoroughness, the type of achievement which enabled one to do a job in the most effective and very often the least ostentatious way. That was the type of achievement which was likely to maintain the supremacy of Britain on the seas longer than would any other.

Sir Charles Parsons, on behalf of the Institution, expressed sincere thanks to the Lord Mayor for the cordial welcome he had extended to its members, and assured him that the great spirit of our mercantile marine exists as strongly to-day as ever it did. The members of the Institution recognised the important part which the port of Liverpool had played in the development of high-speed ocean liners, and believed it would long continue to play such a part. He recalled that the "Mauretania" had held the speed record for the Atlantic for twenty-three years or more, and that the record was wrested from her only last year by vessels of nearly double her tonnage and with more modern machinery; he hoped and believed, however, that the new Cunarder now building would ere long bring back the Blue Riband of the Atlantic to this country.

The members then accorded a hearty welcome to foreign visitors to the conference, who included Admiral J. G. Tawresey (United States Navy), Baron Haersolte (Holland), Monsieur Bourgé (France), Professor Kamo and Mr. M. Tsutsumi (Japan).

It was announced by Mr. R. W. Dana, Secretary of the Institution, that the Association Maritime et Aeronautique of France, of which Monsieur Bourgé is the Secretary General, had invited the Institution to hold its meeting in France next year. Judging from the last meeting it had held there, the members felt sure that the 1931 meeting would be a very pleasant one.

The Economics of Cargo Liners.

A paper by the Hon. L. H. Cripps, C.B.E., on "Some Considerations on the Economics of Cargo Liners," was then read. This paper is reproduced in slightly abridged form on page 72.

Sir John Biles, opening the discussion, recalled that at the beginning of the Institution's meeting in Liverpool ten years ago a paper somewhat similar to that of Mr. Cripps' was presented by Sir Norman Hill, and that in the course of the discussion upon it he (Sir John) had suggested that the development of knowledge on the economics of shipping could not be better developed than by the founding of a Chair of Shipping Economics at the University of Liverpool. That suggestion had not yet reached fruition, but the paper by Mr. Cripps illustrated very clearly the necessity for the systematic study of the subject. Discussing the reason why naval architects should discuss the economics of shipping—although, obviously they were not the persons to discuss the matter in detail—he suggested that it was because the matter was not handled by any institution which dealt purely with shipping. It would be considered very much more fully if there were a school of shipping economics which could bring forward details of the subject for discussion by shipowners, who were competent to discuss them. As to the suggestion that shipbuilders might not be sufficiently interested in the engines of ships after they had delivered the ships to the shipowners, Sir John suggested that that difficulty would be overcome if more papers dealing with these subjects from the shipowners' point of view were read; in his experience, shipbuilders were only too glad to get information as to the running of ships, and papers giving information in that connection would be greatly valued. He did not agree that there had been no advance in regard to the quality of materials. The Admiralty had been adopting higher qualities of steel, and he had no doubt that shipowners had studied the economic efficiencies of those improved materials; if they had not, then there were naval architects who were quite willing to assist them. The author's figures relating to upkeep were unintelligible to him, for he could not understand what "relative cost of engine upkeep" meant in a comparison of ships which were totally different from each other and had such different types of machinery. Why was it that in the case of a twin-screw ship with superheated machinery the relative cost of engine upkeep should be 234 per cent., whilst in the case of another ship it was only 105 per cent.? There must be some undisclosed information which would help one to understand the figures. Again, he had noted that the cost of engine upkeep for the three single-screw turbine ships, superheated, averaged 77, whereas the average of the twin-screw and the single-screw Diesel ships was about 80, and the percentage was as high as 234 in the case of one ship.

Mr. Andrew Hamilton suggested, with regard to the matters enumerated in the paper as being the main points for consideration in cargo liners, that the ratio of hull weight and cargo should be added, and with regard to reduction of engine space he pointed out that the ratio of engine weight to passenger accommodation was also important. In his experience the engine builders were interested in the engines they produced, but their interest was tempered by the price obtainable in competition, which limited the refinements that could be adopted. Continuing, Mr. Hamilton said that much had been done to reduce the cost of building relative to present prices of material and wages. To illustrate this point he gave figures of the costs of building two ships 470ft. long in 1914 and 1929. The first, with a light weight of 4700 tons and a deadweight of 11,800 (ratio 40 per cent.), cost £106,000 in 1914. This ship had triple engines. The second ship, fitted with turbines, had a light weight of 5000 and a deadweight of 11,600 (ratio 43 per cent.), and the cost was £170,000 in 1929, or £160,000 if triple engines had been used. Thus the 1929 cost was only from 50 to 55 per cent. above the 1914 cost.

Mr. J. Hamilton Gibson said that practical interest centred in the figures contained in the author's tables and diagrams, and particularly in the items that were omitted. He could foresee the motor ship Press hailing parts of the paper with delight as proving that the Diesel fuel cost was only about half that of any steam job. It was important, therefore, to point out that none of the steam vessels mentioned was representative of modern high-pressure turbine practice, in which fuel cost would show as well as, if not better than that of the economical oil engines selected for the diagram. Moreover, it would be interesting and instructive to compare the displacement with the deadweight of each class of vessel separately, and to see how that affected the carrying of a given weight of cargo for unit distance; for it was somewhat misleading to lump together in the same category vessels varying from 11,400 tons to 26,800 tons displacement, 11 knots to 15 knots speed, with powers from 2200 to 7500 H.P., and of ages ranging from three to twenty-eight years. On the general question of speed, it should be noted that an increase of speed would make possible a reduction in the number of vessels employed. Thus, on a given itinerary, four vessels of 15½ knots could handle the same cargo as five ships of, say, 13 knots. Developments in propelling machinery were largely responsible for this, the relative first costs and running expenses being a mere matter of arithmetic. But no inquiry could be complete which did not take note of all the present-day alternatives. Referring to the paper, he asked what was meant by the term "theoretical fuel coefficient." The actual fuel coefficient he understood to be $\frac{D^{\frac{2}{3}} \times V^3}{\text{Tons fuel per day}}$. The term "theoretical" would seem to imply ideal conditions of speed, underwater form, propulsion and combustion; therefore any actual performance must always fall short of this ideal. Yet there were two cases in which the efficiency was shown to exceed 100 per cent., which, on the face of it, was wrong. Presumably the so-called "theoretical" coefficient was a long way short of the ideal, and he was curious to know how it was arrived at. The table indicating the saving in length of machinery space effected during the last eight years related only to oil engines, but similar and even more striking savings had been attained with steam propelling machinery during the same period. About six months ago he was associated with a design of high-pressure geared turbine machinery of similar power to that of the last vessel mentioned in the author's table; that machinery, boiler and engines, occupied no greater overall length, its weight was less than that of Diesels, and it had cost some 35 per cent. less. This meant a saving of 800 tons in weight and £32,000 in cash. Even allowing for the extra fuel consumption in the steam job, there was still a balance in favour of steam amounting to 500 tons, taking into account the relative weights of machinery plus fuel for a long voyage of, say, 14,000 miles.

Mr. Harold E. Yarrow pointed out that important advances made recently in steam propelling machinery made any comparison with steamships designed and constructed some years ago misleading; the average age of the steamships dealt with in the paper was about fourteen years, whereas the average age of the motor ships was less than five years. Both cargo ships and passenger ships were included in the tables, and there were big variations in speed and other important factors which made any correct comparison almost impossible. For instance, the figures in Table II. might be regarded as showing that a twin-screw ship was nearly three times as expensive in engine upkeep as a single-screw ship. The information in the tables lost a considerable amount of its value because the basic figures in pounds, shillings and pence were not stated for the repair costs, or for such other expenses as Board of Trade and Lloyd's survey fees. It was frequently stated that the repair costs of oil-engined ships—especially those of larger powers—were very high. In the immediate future there was, of course, a field for both steam and motor ships. In that connection Mr. Yarrow mentioned that a design had been worked out for a vessel of 7000 S.H.P., 14½ knots, high-pressure machinery and oil-fired water-tube boilers, and for a 10,000-mile voyage the total weight of machinery and bunkers was appreciably less than with oil engines. The steam machinery occupied no more space and the first cost was less. Assuming the usual difference in cost between boiler and Diesel oil, the fuel cost for the voyage with the steamship was less than with the motor ship. In the case of large passenger vessels in service it was well known that the oil consumption with modern steam machinery and water-tube boilers per S.H.P. for all purposes, including cooking and heating, was about 0·6 lb. per S.H.P. per hour; that result was obtained with the ordinary fuel oil and not with the more expensive Diesel oil. A fuel consumption of 0·5 lb. of oil per S.H.P. for the machinery of a modern steamship was within sight. If comparison were made with the cargo boats of the "Beaver" class belonging to the Canadian Pacific Steamship Company, which were equipped with steam machinery, water-tube boilers and mechanical stokers burning coal, the cost of fuel was considerably less than for oil engines. Those vessels had given steady service on the North Atlantic, maintaining their power and efficiency with remarkably small upkeep costs since they were put into service, in spite of the fact that they worked to a very strenuous schedule. With regard to engine space, he said the latest design for steam machinery of 8000 S.H.P., normal and 9000 S.H.P. overload, having two water-tube boilers, required only 54ft. overall. A limitation of the oil engine was that it could not be worked above the designed power without trouble; in fact, there were rumours—apparently well founded, as they were not contradicted—that a good many of the larger-powered motor ships could not even be run at their designed power for fear of breakdown. Steam machinery, on the other hand, could be pressed to a higher overload with safety. For example, the "Mauretania" had beaten her own record when over twenty years old. Again, vibration must be greater with a reciprocating engine than with a rotary engine, and he asked Mr. Cripps if it had been found excessive and of such an order as to lead to depreciation of the structure of the hull or the seatings. Did he contemplate having to re-engine any of the motor ships? Comparison of a modern motor ship and a modern steamship would indicate the remarkable advance made in recent years in steam machinery by the introduction of high-pressure turbines working in conjunction with water-tube boilers.

Mr. R. J. Walker, dealing with the problem of upkeep, said some of the older steamships suffered from "Condenseritis," but he believed that, as the result of the Canadian Pacific Company's work, the difficulty had been almost, if not entirely, eliminated. It was important that in any comparison of steam machinery and oil engines modern units should be the basis of the comparison. There were many points in the paper which required further consideration if one were to make a correct analysis of the results, and he would be glad if further information could be given at a later stage.

Mr. G. S. Baker (National Physical Laboratory), who has been responsible for the testing of the designs of 400 cargo ships during the past ten years and for the economic proportioning of 120 of them, commented upon the author's statement that the running costs of the latest type of ship used by Alfred Holt, Ltd., worked out at only 10 per cent. above the pre-war rate, and attributed that largely to the fact that a great deal of the expense of running was incurred outside this country. In that connection Mr. Baker said that recently he had been able to compare the results obtained on four foreign-built ships, having foreign-built oil engines, running on the same route and managed by the same company, with the results of two British-built ships having British-built engines. The fuel coefficient of the British-built ships was 10 per cent. below that of the foreign-built ships, both in ballast and in load conditions. Therefore we were at least 10 per cent. better in regard to ship design than our foreign competitors—a fact which should be made known. With regard to the author's statement that, so long as we maintained a competitive system trial and error would tell us whether our methods as shipowners individually were adequate, Mr. Baker urged that there should be no trial and error in the design of a ship. By taking full advantage of the knowledge which existed, the shipbuilder and shipowner could ensure that his ship was at least as economical as any ship of its class in the world—and that knowledge really existed in England. The author had also spoken of curious and incomprehensible results being obtained. Such results were obtained, not by "trial and error," but by "ignorance and error." The author's suggestion that there had been no progress in regard to quality of materials led Mr. Baker to chide the shipowners in respect of the small financial support they gave to research work, and he urged them to ask themselves how much they had spent on research on materials during the last ten years. To a great extent the amount would be a measure of the progress made as regards their own requirements. They could not expect other people to do their research unless they paid very heavily afterwards.

Referring to the National Tank, he said that the second basin had been approved, and, through the efforts of Mr. J. H. Thomas, £45,000 had been allocated for it. The tank would be 20ft. wide, 9ft. deep and 678ft. long, and capable of dealing with a speed of about 30ft. per second. It would enable work to be carried out for firms in a much shorter time than was possible previously and to make better progress with research work. But to a great extent the latter depended on the industry, as the funds for it must come partly from that source. For many years the best knowledge on ship form and propulsion had been found in this country, but Italy, Germany and Holland were building, or had built, tanks during recent years in a determined effort to level out the advantage. It was significant that the total number of people employed in the tank work in the two tanks at Hamburg and Vienna was nearly double the number employed in all the British tanks; yet the total

tonnage of German-owned steamers was only one-fifth of that of British-owned steamers. In 1927—he had not the figures for 1928 and 1929—the number of designs tested in British tanks was only about one-fifth the number approved by Lloyds. That was not "trial and error," but "arrogance and error," and the betting was 4 to 1 that the industry had made an unnecessary mistake. Finally, he said that with this new tank the research was going to cost more. For the last two years shipbuilders had subscribed some £500 a year towards that research, and the shipowners had subscribed about £750—and that was from an industry represented by 20,000,000 tons of shipping. It was not sufficient to ensure proper progress in a competitive age.

Mr. Sterry B. Freeman (chief superintendent engineer, Alfred Holt and Co., Ltd.) said that the fuel coefficient which had been referred to was equal to $\frac{\text{Displacement}^{\frac{2}{3}} \times \text{speed}^3}{\text{Tons of fuel per day}}$. The term Displacement$^{\frac{2}{3}}$ corresponded practically to the wetted skin area of the hull, which accounted for over 80 per cent. of the total resistance. Moreover, the speed and fuel consumption could be measured accurately. There was also, to compare with that, a so-called theoretical fuel coefficient. That meant that if the ship proceeded at her designed deadweight and 85 per cent. of the total draught at her designed speed, using her designed horse-power to accomplish that speed, and if that horse-power were obtained when using the designed amount of fuel, one obtained the designed fuel coefficient. For a saturated steam job of the old-fashioned type, that figure was 16,000. If it were superheated, one would expect an improvement in fuel consumption, so that the ideal fuel coefficient would become 19,000, instead of 16,000. Converting that into terms of a coal-burning turbine-driven ship, instead of a reciprocating engine, the consumption was reduced further, and the coefficient became 21,000. The ratio between coal and oil was well known, and if oil were burned instead of coal the figure would be 33,000. If the oil were consumed in an oil engine at, say, 0·4 lb. per S.H.P. per hour, the figure would become 64,000. With a saturated steam job, having a coefficient of 16,000, coal would be burned at the rate of 1·6 lb. per S.H.P. per hour, which was four times the rate of 0·4 lb. per hour for oil in an oil engine.

Referring to the comments made as to the relative merits of oil and steam engines, he said the paper was not written in order to advocate oil engines as being preferable to turbines, but simply to put forward, in a manner which should appeal to the shipowner, what was done in regard to a particular fleet. Plenty of results with ultra-modern steam plant, with high-superheats, water-tube boilers, &c., were available. Replying to the question by Sir John Biles as to the cost of machinery, he said he had compared the cost of a set of single reduction turbines, two Scotch boilers, steam superheated to 200 deg. Fah.—a complete installation in accordance with the firm's usual requirements, with the cost of twin-screw oil engine machinery of the same power and the difference was just 7 per cent. The shortening of the engine-room was due largely to supercharging. An engine of eight cylinders of 29in. diameter and 5ft. stroke, which in 1923 was giving 2400 H.P., was now giving 5000 H.P. The cooling arrangements in the more modern engines were better, and the engines were running at higher rates. Part of the advantage was due to the use of airless injection.

With regard to the use of coal, all were anxious to use it instead of oil, because it was home-produced. Alfred Holt and Co. were still experimenting with a powdered fuel fired boiler, and hoped to find some means of adapting it for use in the fleet, but it was not so simple a proposition as some people appeared to think it was.

Mr. Cripps made a brief reply, and intimated that he would answer the discussion at greater length in writing.

MECHANISATION OF AIRSHIP HANDLING.

In our issues of March 11th and 18th, 1927, we gave a full description of the Cardington airship mooring tower, and in our issue of December 28th, 1928, we published particulars of the improved form of machinery employed at the St. Hubert tower erected in Canada. Major Scott, in the course of a paper, referred his audience to these articles for details of the construction of the British towers, and added a few particulars of the alternative form of tower developed in the United States. The American steel tower is only of sufficient height to keep the airship cars clear of the ground when the vessel is on a level keel. The after car is anchored to a weighted trolley or bogey in such a way as to prevent any motion of the tail upwards or downwards. Major Scott, it would appear, is not convinced that the American tower possesses any balance of advantages over the British form. The concluding portion of his paper dealt with the important problem of handling an airship between the tower and the shed. The author described a system which is in an advanced stage of development in this country, whereby the airship is transferred from the tower to the shed or *vice versâ* by means of a short transporter tower mounted on a caterpillar base and hauled by a tractor. For the "R 100" or "R 101" the transporter tower would be about 70ft. high. A party of fifty or sixty men, including the mooring tower crew, would be required to effect the shedding or unshedding operation. It is believed that with a transporter tower an airship could be handled from the shed to the mooring tower or reverse-wise in winds up to 30 or 35 miles an hour velocity.

This paper was not discussed, but the chairman, Sir Charles Parsons, in thanking Major Scott, referred as a matter of interest to a German type of airship shed which could be swung round to suit the wind, so that the airship could be taken into it in the direction of the up wind.

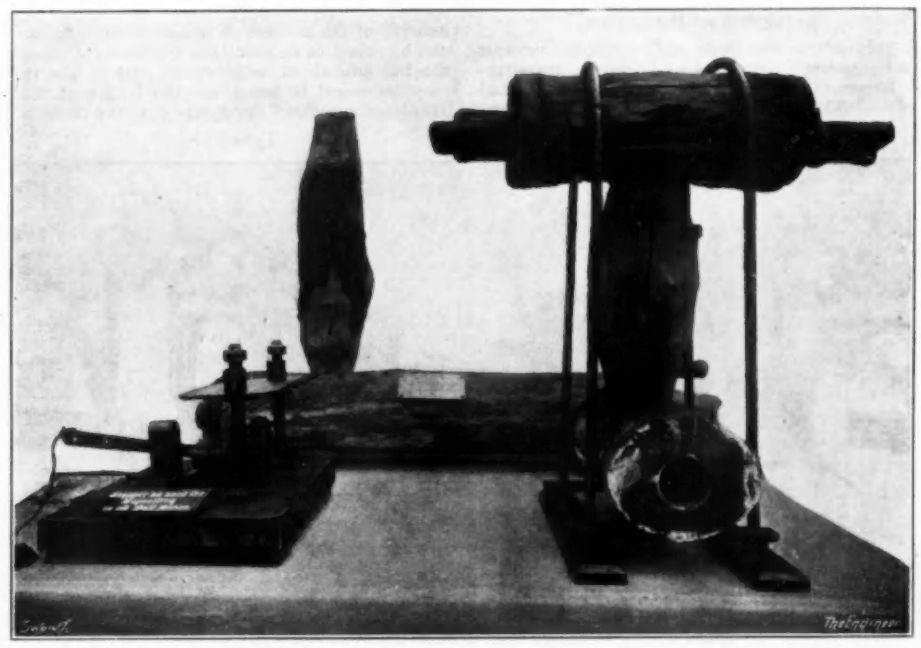
(To be continued.)

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

WOODEN BRINE PIPES.

SIR,—For some little time past correspondence has been going on in *The Times* with reference to the use of wooden pipes for the conveyance of water in London. It is not surprising, of course, to find that similar pipes were in common use for the conveyance of brine in the salt districts; during excavation we have come across a considerable number and some, we believe, are still in use. We were fortunate enough some little time ago to discover a really unique sample of distribution of brine by wooden pipes, as shown in the accompanying photograph. The specimen right at the back is merely a length of pipe with



what is probably the stem of a tee piece—note the excellent state of preservation of the bark—driven into it, but the example in the foreground to the right is extremely interesting, as it consists of a tee piece rising out of the main, which has been sawn off, with plugs at both sides of the head, which provide for the control of a supply of brine into two salt pans side by side with the brine main running between them. With the exception that a portion of the main has been cut off, the tee piece has been shown exactly as discovered with the iron cramps to hold it together. It will be noted that the ends of the tee are hooped.

Just to complete the story of the photograph, the small hammer-like object in the left foreground shows what is locally known as a "clapper" used to signal up the shafts of old salt mines. The rope, of course, went to the bottom and was pulled a predetermined number of times to convey certain signals. It will be noted that the flat plate, which is really the gong, is free to move up and down within limits, and this gives a penetrating, ringing sound totally different from what it would give if the plate were fast.

Time is passing and these old things disappear, so possibly you may think it worth while having a record of these interesting old exhibits.

Some time ago we had the pleasure of sending quite a fine specimen to the museum of the Institution of Mechanical Engineers.

SALT UNION, LTD.,
GEO. W. MALCOLM,
Managing Director.

Winsford, Ches., July 15th.

UNEMPLOYMENT.

SIR,—Your correspondent "Conservative" combines so much wisdom with such an entire misunderstanding of the basic causes of prosperity that to leave his statements unchallenged might lead some people to think that they are right. If I may be permitted to take up the challenge, I shall deal with the points in his letter in the order in which they occur.

Any country attempting to carry on by itself would be up against the same sort of problems as a county town, village, or factory attempting to do likewise. It becomes increasingly impossible to do so when a large amount of manufactured goods must nowadays be classed as raw material.

Pensioning off the older workers by a contributory scheme would definitely lead to better efficiency and more openings for the young.

Since the agricultural and textile industries are in the depths of depression it is difficult to see how using them as a diversion from engineering could be of any value.

The number of people with the combination of will power, ability and constitution necessary for the managing directorship of a large firm is few. Hence the large salary. There is a world competition for such men.

The breaking up of trusts into small companies would not prevent such companies working together as a trust. It would merely increase the working costs.

No legislation could more effectively destroy a country's prosperity than the limitation of dividends so that the public could benefit unduly at the expense of the shareholders who subscribed the capital. Even if the public used their profits for investment, they would invest abroad, and in any case the capitalists would do so.

Prosperity dwindles in countries whose governments discourage millionaires or the making of them. Maximum employment is produced by allowing wealth free access to those who want to make the best use of it. But it is the machine that should be sweated and not the labourer, and good government is one which preserves the balance between the throttle of capitalism and the brake of socialism.

The prosperity of a country is almost entirely dependent upon its Government. With all their natural resources, Russia and China are starving, the prosperity of America is dwindling, whilst that of France is relatively high and is likely to remain so as long as the present *régime* holds.

Since we shall have to do without coal some day, we should betray more foresight by learning how to be independent of it than by conserving it for our own use. We should gain more by seeking to preserve our non-wasting assets.

R. DOUGLAS ARCHIBALD, D.Sc.

SALVAGE OF WASTE.

SIR,—It is said that the Ford Company, of America, is buying ancient motor cars at a price of about £5 a piece, with the object, ostensibly, of bolstering up the purchase of new cars in their place. But the old vehicles are not just thrown away. Their various components are carefully sorted over, and such parts as are serviceable are saved in their original condition, while the remainder is sent back for re-fabrication, with the result that there is little left beyond the proverbial squeak of the Chicago pig.

Now, this process is, of course, an old story, and is particularly familiar to the French, with their chiffoniers, who sort over all refuse and put it into re-useful categories. But such an idea seems quite foreign to the American instinct, which seems to be the scrapping outright of anything that has served its purpose.

It is said that Henry Ford is going, at Dagenham, to produce all the necessary power for a large factory from one of the refuse dumps of London, while he is apparently making money by buying broken-down cars at knock-down prices. If these things are practicable, is it not time that our refuse disposal systems were reorganised and converted into a money-making proposition, instead of being a constant expense? I have observed your account of recent continental efforts towards the utilisation of household refuse for manurial purposes, and have studied the schemes at several provincial places for the partial utilisation of refuse, but the subject does not seem to me ever to be treated on broad lines, so that the utmost is recovered from each ingredient of that refuse.

Surely it is within the capacity of engineers to provide plant which would segregate the various classes of waste and return them to their original purpose—although the matter might need some propaganda at the origin of that waste—without the process entailing a charge on the community. The Ford policy should give encouragement.

London, July 14th. BOFFIN.

The Royal Agricultural Show at Manchester.

No. III.*

THE Show at Manchester concluded on Saturday last in brilliant weather, and although there was an improvement in the attendance of the public on the last day, the total for the week showed a serious falling off when compared with that at similar Shows previously held in Manchester. This falling off, however, is not a matter for surprise when the present spending power of the people in this industrial area is properly assessed, and it would appear that those responsible for the financial affairs of the Royal Agricultural Society should carefully consider whether the time has not arrived for a reduction in the charges for admission to something approaching those in vogue before the war. The total attendance at Manchester was 101,754, compared with 124,000 at Harrogate last year and with 149,000 at Manchester in 1916.

The two outstanding features of the implement section this year were the increase in the number of exhibits of high-speed crude oil engines and a further reduction in the number of steam engines on view. Writing largely from memory, we are probably correct in stating that the Manchester Show was the first from which the stationary steam engine was wholly absent, while the number of portable steam engines—once such an important section—was very small.

BOULTON AND PAUL, LTD.

A very attractive little self-contained automatic electric power plant of 1-kilowatt capacity—Fig. 16—was shown by Boulton and Paul, Ltd., Norwich. This little plant has an automatic switch

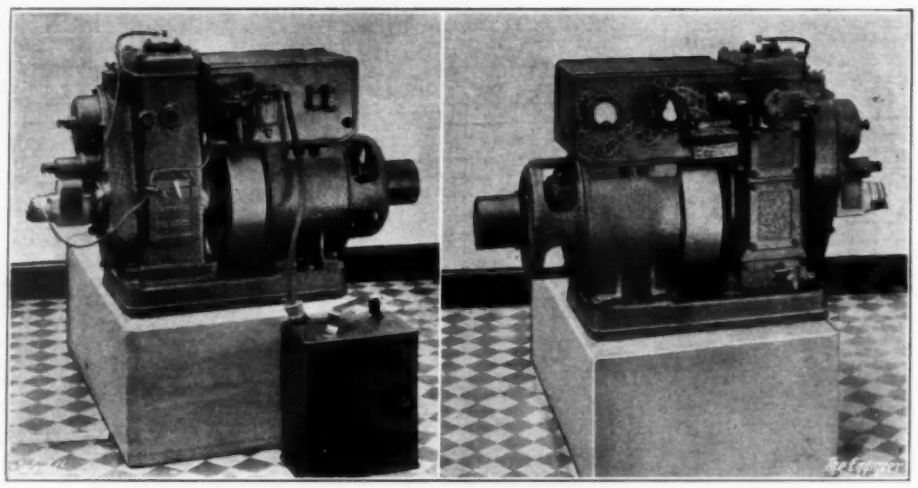


FIG. 16—SELF-CONTAINED ELECTRIC POWER UNIT—BOULTON AND PAUL

controller for shutting off the current in case the engine stops for want of fuel or lubricating oil, and thus preventing the batteries from being discharged. The same switch automatically stops the engine and turns off the lights if it is excessively overloaded. There are two separate governors, one, centrifugal, to control the engine speed when used for belt driving, and an electric governor to control the rate of flow of electricity to the batteries. Magneto ignition is provided and the lubrication is positive and automatic. One of the most important advantages of the plant is the accessibility of everything which affects its working. There is an inspection door on each side of the crank case and an independent sludge door for cleaning the crank case. The switch gear and carburetter are equally easy of access, and the fuel feed is supplied by a diaphragm pump, mechanically operated from the engine. The fuel container is a standard 2-gallon tin placed on the floor beside the plant; into it a flexible suction pipe is inserted. The engine is rated at 2 B.H.P. at 1200 revolutions per minute. The bore of the cylinder is 69·5 mm. and the stroke 76·2 mm. The valves are side by side and the cylinder head is detachable without breaking any pipe joints. The dynamo is mounted on the extended cast iron bed-plate, and is of the four-pole type, shunt wound with series winding for starting, which is cut out automatically.

W. H. BAILEY AND CO., LTD.

There is much to be said for the use of the hydraulic ram for supplying water for farm and estate purposes on account of its simplicity and freedom from trouble. Appliances of this kind run for years night and day with little or no attention. The Caliban hydraulic ram, made by a Manchester firm—Sir W. H. Bailey and Co., Ltd.—which was shown, is a typical example of this type of pump. The output depends chiefly upon the amount of fall obtainable, 3ft. being about the minimum. As the height increases so does the power of the ram, the relative height of the source of supply above the ram and the elevation to which it is required to raise the water determining the proportions of the water raised and that runs to waste. Generally, it may be calculated that about one-seventh of the volume of water falling into the ram can be raised to an elevation five times the height of the fall and about one-sixtieth part of the volume may be raised to ten times the height of the fall. The length of the "drive pipe" varies according to the fall and the height to which the water has to be forced. The Caliban ram—Fig. 17—is of the simplest design, comprising two castings, one of which has four branches for the drive supply, delivery, waste and air. The other casting forms the air vessel.

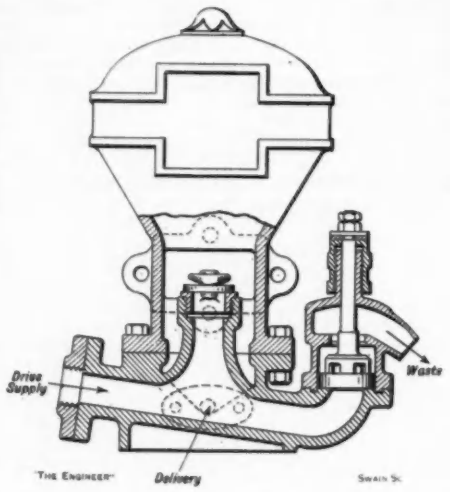


FIG. 17—HYDRAULIC RAM—BAILEY

The delivery valve is of rubber, working on a gun-metal seating, and the escape valve is entirely of gun-metal. Covers are provided on both sides for access to the delivery valve, and the air vessel can be removed for examination without necessitating the breakage of any pipe joints. A snifting plug in the base of the ram automatically supplies air to the air vessel. Other exhibits on Messrs. Bailey's stand were electrically operated air pumps. A small portable plant suitable specially for garages has an air compressor and electric motor mounted on a small truck which can be run about by hand. The motor develops ½ horse-power and the compressor has two vertical water-cooled cylinders with metallic valves and seats. It is suitable for a pressure of 150 lb. per square inch, and has a displacement of 2·6 cubic feet of free air per minute. For lighter work Messrs. Bailey showed a little plant consisting of a compressor driven by a ¼ horse-power electric motor through a Whittle belt. The compressor and motor are mounted on a wooden base fitted with a handle to enable the set to be carried about.

PETTERS LTD.

As usual, this firm had a prominent position in the machinery-in-motion section. Its exhibits included oil and petrol engines of sizes varying between 1½ brake horse-power and 80 brake horse-power for all kinds of purposes. A neat 2 B.H.P. lighting plant for use without storage batteries is worthy of special mention. The engine runs at 1000 revolutions per minute and is direct-coupled to a compound wound generator of 950 watts electrical output at 110 volts. The cooling water system consists of a fan-cooled radiator placed on top of the generator, the fan being belt-driven off the engine. The engine is fitted with an electric motor of the standard car-starting type with a Bendix drive. The controller is contained in a small cast iron box placed above the generator, and the whole plant is carried on one base plate. The controller is of an improved pattern and very simple, enabling the plant to be used with safety with little attention beyond that required for filling the fuel, oil and water tanks from time to time. The whole plant is quite self-contained, readily removable and specially suitable for use where batteries would be liable to damage through disuse over long periods. Another engine which we have selected for special mention is the 80 B.H.P. twin-cylinder improved two-stroke "Atomic" high-compression airless injection engine, which was shown for the first time at the Show. This is one of a series of two-stroke engines built in single units of 25, 40 and 65 B.H.P. and in multiple units of 1, 2, 3, 4, 5 and 6 cylinders up to 400 B.H.P. Being of the two-stroke type these engines have the advantage of simplicity, there being no valve mechanism. Although totally enclosed, they are noteworthy for the ease of accessibility and their capacity to use a wide range of cheap fuels. Several sizes of portable vertical engines up to 5 B.H.P. for operation on petrol or paraffin were shown. The carburetter employed enables the fuel to be passed direct to the cylinder instead of into the crank case, as in the case of some other makes of two-stroke engines. As petrol requires a higher compression than paraffin for most efficient operation, a removable compression ring is provided. It should, however, be pointed out that the engines will work satisfactorily on either kind of fuel with or without the ring up to about two-thirds of the maximum load.

STEAM WAGONS AND TRACTORS.

The number of exhibitors of steam-propelled vehicles was smaller than in the past, but those who were represented have reason to be satisfied with their products, which were chiefly of the six-wheeled variety. The Sentinel Waggon Works, Ltd., Shrewsbury, showed four and six-wheeled vehicles for loads up to 15 tons. The Yorkshire Patent Steam Wagon Company, Leeds, showed a rigid six-wheeler of 15 tons capacity, fitted with four speeds; Fodens, Ltd., Sandbach, displayed 6 and 12-ton wagons and a steam tractor. The 6-ton wagon—Fig. 18—shown by the

FIG. 18—SIX-TON STEAM WAGON—FODENS

* No. II. appeared July 11th.

last-named firm, is of the two-axle pattern with two wheels on the front and four wheels on the driving axle, all fitted with pneumatic tires. The power unit is of the simple expansion kind, with two cylinders, 5in. bore by 7in. stroke, placed transversely under the frame, with valves of the poppet type actuated by cam shafts. The transmission is by cardan shaft, worm and worm gearing to the back axle, and both the crank shaft and gears are enclosed and run in oil baths. The engine develops 80 B.H.P. at 500 revolutions per minute with steam at 250 lb. pressure per square inch. The boiler is of the horizontal, semi-water tube type.

Richard Garrett and Sons, Ltd., Leiston, showed a steam tractor with the appropriate name of "Suffolk Punch," which has been specially designed for heavy haulage and is eminently suited to colonial uses. Drawings of this tractor are given herewith—Fig. 19. This vehicle has a rigid twin-driving axle unit, which is fitted to one pair of inverted semi-elliptic springs, housed in pressed steel brackets which, in turn, are bolted to the main frame side members. The spring centres are contained in cast steel brackets which have means for adjusting the tension of the chains, and cast steel radius rods maintain the axles in position there by keeping the chain centres constant whatever the position of the axles may be. The ends of the rearmost radius rods are carried in hemispherical bearings. Each of the four driving wheels has freedom to move vertically relatively to the others without distorting the frame. There is no differential in the rear axle unit, the double chain drive being so arranged that one differential gear incorporated in the engine unit serves for all four driving wheels. The drive is transmitted from sprockets on the engine countershaft to the foremost driving wheels and by double roller chains to the rearmost wheels. The engine is of the poppet valve type. It consists of two high-pressure, double-acting cylinders cast in one block. To each cylinder there are four steam valves of the poppet or mushroom type, with an equal number of exhaust valves, the whole eight valves being operated by a single cam shaft. The engine itself is reversible and the cut-off point of steam admission can be changed to suit the constantly varying load. The power unit is slung in the chassis frame by three-point suspension, the two rear attachment joints of which are mounted on semi-elliptic pivots. By this method of suspension, any possibility of frame deflection setting up stresses in the engine components is entirely eliminated. In order to combine lightness in weight of the reciprocating parts necessary to produce rapid acceleration with the minimum amount of vibration, and also at the same time to provide ample strength, the pistons are machined from steel pressings, the crossheads are steel and the connecting-rods are I section drop forgings. The pistons and crossheads are ground in one section, after being fitted to the piston-rods, thereby ensuring perfect alignment. The piston-rods are each fitted with two separate glands, which effectively prevent condensed water passing through the oil-bath casings. All moving parts are totally enclosed in an oil-bath casing, and inspection doors are provided.

There are three sets of independent brakes operating on the four rear driving wheels. On the forward driving wheels there are two sets of internal expanding brakes, one operated by a hand lever and the other by a foot pedal, both controls being situated in the driver's cab. On the rear driving wheels there is one double set of steam-operated brakes; that is to say, two brake drums on each rear wheel. This brake is operated by a steam valve, mounted on the steerage column. In all, there are no less than sixteen brake shoes in the rear axle assembly.

The boiler is of the vertical cross-tube type, designed for a working pressure of 250 lb. per square inch, and is of ample capacity for the tractor's requirements. A patented inspection door gives access to all tubes for cleaning and inspection, and the whole boiler can be thoroughly cleaned in from two to three hours. A superheater is incorporated with the boiler and ensures economy in fuel and water. There is a large and comfortable cab with all controls accessible to the driver, who has a clear view of the road. The overall length of the tractor is 18ft. 6in.; width, 7ft. 3in.; height, 9ft. 9in.; turning circle, 52ft.; maximum draw-bar effort, 8500 lb.; front axle weight, 2 tons 9 cwt.; rear axle weight, 10 tons 1 cwt. The equipment includes a powerful winding drum and dynamo lighting set. Messrs. Garretts also showed six-wheel undertype steam wagons of their standard type.

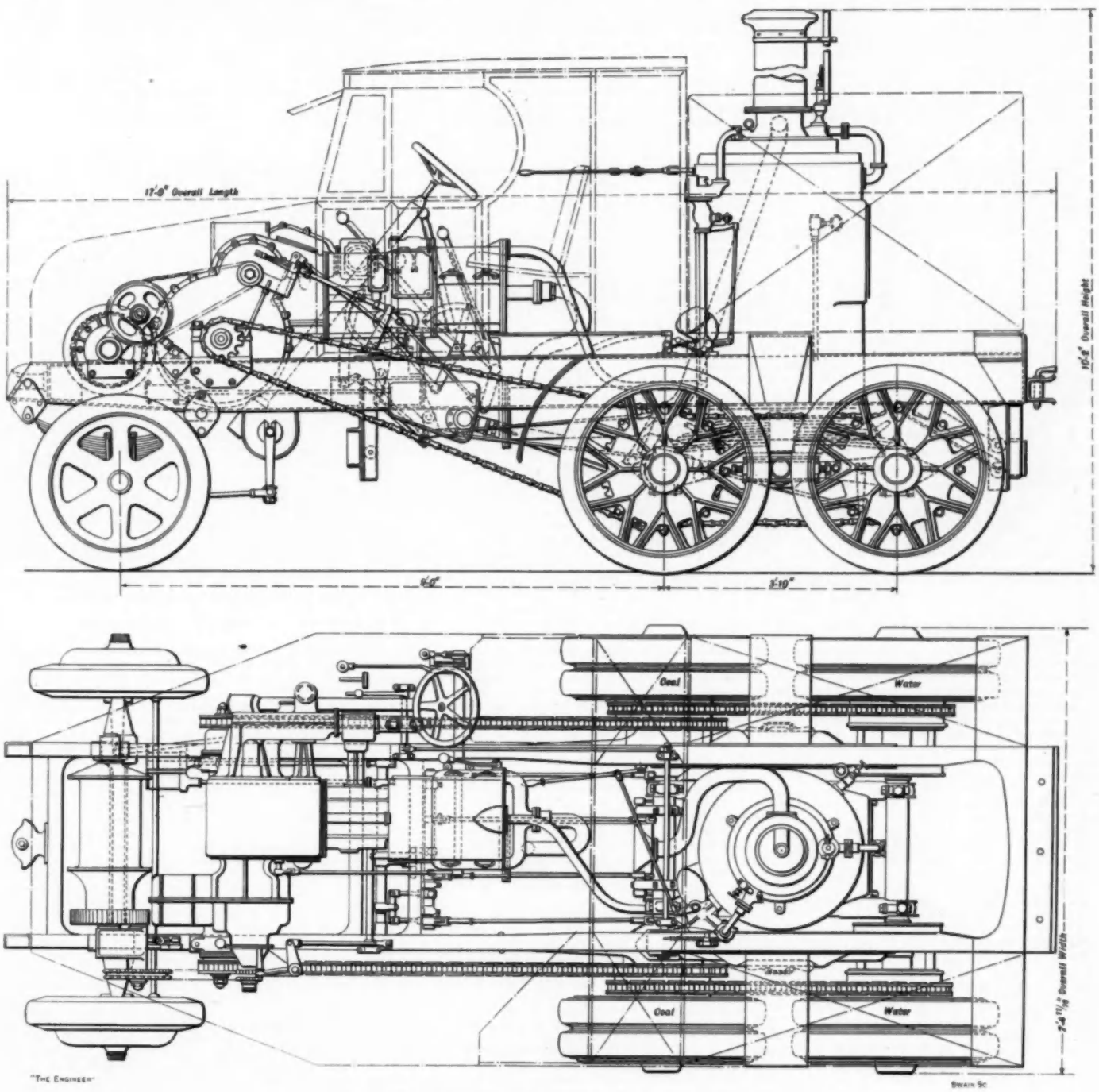


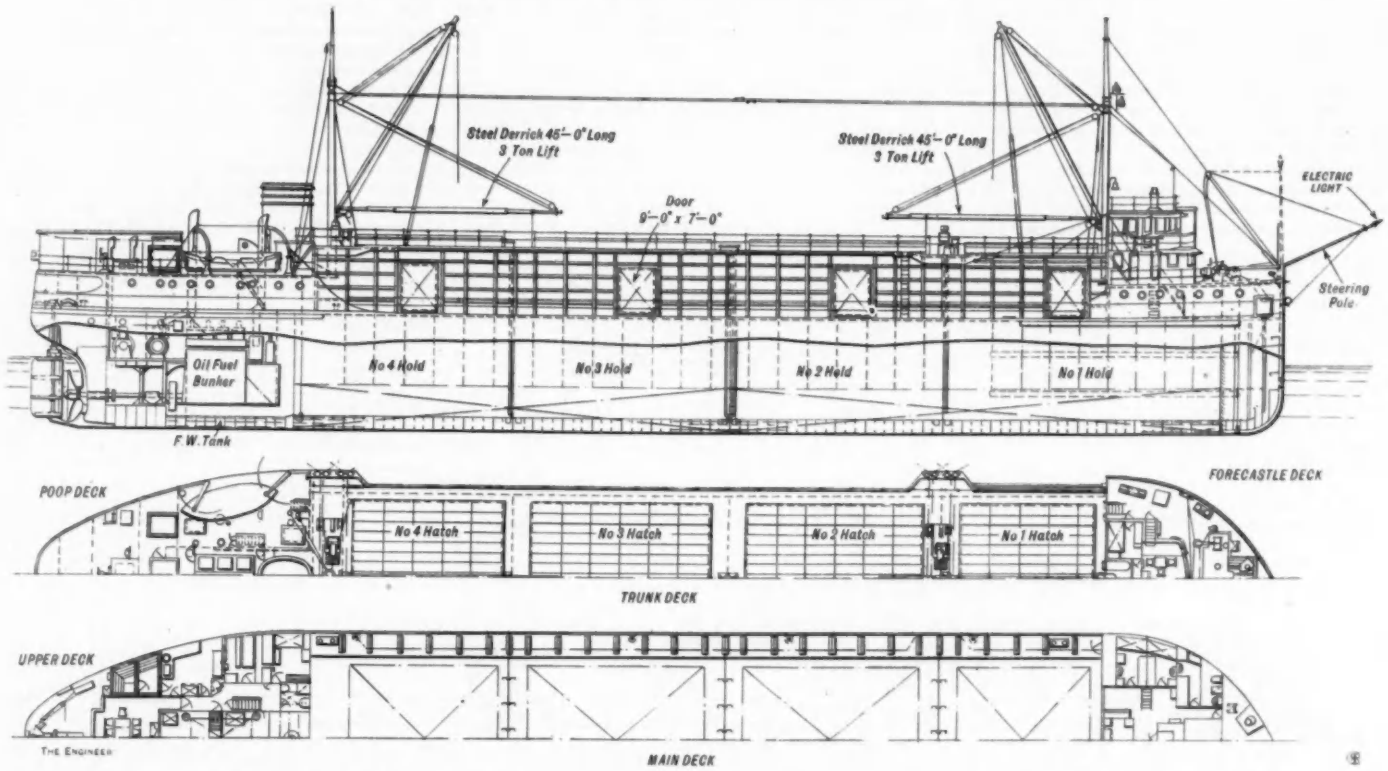
FIG. 19—HEAVY DUTY STEAM TRACTOR—GARRETT

(To be continued.)

IT is announced in the *South African Mining and Engineering Journal* that the result of the prospecting operations near Inyantue, some 30 miles south of Wankie, has been to show that coal measures exist for a distance of about 2½ miles along the railway, and that boreholes have revealed the existence at a moderate depth of a seam of coal 8ft. to 10ft. in thickness. This coal, it is said, has an evaporative power about the same as the Wankie coal, and superior to that of Witbank.

THE PAPER-CARRYING VESSEL "THOROLD"

EARLE'S SHIPBUILDING AND ENGINEERING COMPANY, LTD., HULL, BUILDERS



A Paper-carrying Vessel.

We reproduce herewith the general arrangement drawings of a vessel which has been specially designed for an unusual service, and has recently been sent away from the shipbuilding yard of Earle's Shipbuilding and Engineering Company, Ltd., Hull, for service on the Great Lakes of America. Her function will be expressly to take paper from the mills on the Canadian side of the lakes to the United States side, where it will be dispatched by rail to the consuming centres. The vessel has been built to the design of Mr. Walter Lambert, of Messrs. Lambert and German, Montreal, and her construction has been superintended by Mr. F. G. Brownlie, of Glasgow.

The "Thorold," as she is named, is a single-screw motor-driven vessel, 250ft. long, 43ft. 9in. broad, and 23ft. deep. She has four holds, four hatches, two masts, two 3-ton steel derricks, electric windlass, four electric winches for cargo and mooring purposes, also an electric winch fitted aft for warping purposes. An electric hydraulic steering gear is fitted directly over the rudder head aft, controlled from the bridge forward by a telemotor. Water ballast is carried in the peak tanks and cellular double bottom and also in large side tanks fitted over the bilges throughout the holds. Oil fuel is carried in deep tanks in the engine-room.

The framing and steel work in the holds is of novel design specially arranged for the safe carriage of newsprint, and on deck a large trunk way, 33ft. 6in. wide by 13ft. 3in. high, is fitted from the poop to the forecastle to give the large capacity necessary for the special cargo carried.

On the starboard side of the trunk four large cargo doors are fitted. Inside the forecastle there is a large hall with three state-rooms and a bathroom for the owners' accommodation and cabins for the officers and crew. On the forecastle deck there is the captain's accommodation and the owners' parlour. Over this a large teak pilot house is provided for navigating purposes. Inside the poop accommodation is provided for engineers and firemen, with a large galley and a small refrigerated store. Two "Mechan's" steel lifeboats are accommodated on the poop deck.

The ship is propelled by a single-acting, two-stroke, four-cylinder, 470 mm. by 820 mm. oil engine of about 1000 B.H.P., supplied by Sulzer Bros. The engine is enclosed and of the crosshead type fitted with forced lubrication and is directly reversible by compressed air. The compressed air for fuel injection and for starting and reversing is provided by a three-stage air compressor, directly driven from the main shaft. The engine is also provided with a direct-driven scavenging air pump.

The auxiliary machinery consists of a lighting and stand-by set combined with a general service pump. This set comprises a 15 B.H.P. Kromhout engine driving at one end a 7½-kW dynamo for lighting purposes, supplied by the Sunderland Forge Company; and at the other end an 8 cubic feet Reavell air compressor. It is also arranged to drive, by means of a chain, a pair of 7-ton stand-by plunger pumps for general service. Another auxiliary unit is a 35 B.H.P. Kromhout engine driving, at one end, a 23-kW generating set, supplied by the Sunderland Forge Company; and at the other end a 39 cubic feet Reavell air compressor. There are also a stand-by 35 B.H.P. Kromhout set driving one 39 cubic feet Reavell air compressor, and a 70 B.H.P. Kromhout engine driving a 45-kW dynamo, supplied by the Sunderland Forge Company, Ltd. There are in the engine-room equipment one 250-ton Drysdale Contrex ballast pump, two 7-ton Truslove oil transfer pumps, one fresh water pump, and an oil purifier.

Steam Turbine Failures.

The house journal of the Vulcan Boiler and General Insurance Company generally puts forward the information which comes to its knowledge in a really impartial manner; so it seems noteworthy that a prominent article in that publication should be prefaced with the remark that "steam turbines have lately been prominent from a breakdown point of view." In support of this contention four cases are cited, but it should be noted that none of the machines was of any great importance, as to size, while all but one were not in their first youth.

Vulcan gives the account of these failures, which are quite interesting in themselves, as follows:—

The first concerns a 1000-kW condensing steam turbine of the combined impulse and reaction type, driving a generator through gearing made in 1914. Blade breakages occurred a few months ago, involving renewal of certain stages in the rotor. A further failure recently occurred of these new blades, and obviously a thorough investigation was called for. It had been noted that during the last few months the turbine did not work very smoothly, and examination of the gearing showed that backlash to the extent of three thirty-seconds of an inch was apparent.

When the turbine was run with the coupling between itself and the gearing disconnected, the machine ran smoothly, but when the gearing was coupled up, vibration was felt. It was found that the wear in the gear teeth was uneven, with the result that distinct impulses were transmitted at each revolution of the gear wheels. The vibration thus set up appears to have affected certain sections of the rotor blading, and new ones were fitted with an additional lacing strip, the gears, of course, receiving attention at the same time.

The second case under review is that of an old 500-kW reaction type turbine made in 1906. This machine is of the double-flow type, *i.e.*, the steam is admitted to the centre and passes outwards to exhausts at each end. Whilst at work no defects were noticed with this machine, and it ran smoothly and with freedom from vibration. When, however, undergoing a recent periodical opening out, it was found that the whole of the blades in the last low-pressure row at the generator end were missing, and from the blackened appearance of the ring groove in the rotor, had been out for some little time.

Search was made, and the missing blades were found in the bottom of the water cooling tower. In addition to this row, the fourth from the same end of the rotor was found to have a number of blades loose. They had risen from their groove a distance of nearly one-eighth of an inch and had rubbed on their tips. It is evident that the timely examination saved extensive breakdown in this instance, as, had these blades in the fourth row come adrift, they must have inevitably passed through the succeeding rows.

The third case referred to a turbine of the horizontal impulse type of 2500 kW output. This machine was practically a new one, having been in service less than twelve months. All went well until a few weeks ago, when the makers made an examination of the machine and took the opportunity of dressing up the thrust block pads, which were slightly scored. The turbine was then re-assembled, and all went well for a fortnight, when a grating noise was heard, and the attendant fortunately stopped the machine immediately. Examination showed that the turbine rotor had moved endways axially for a distance of about three thirty-seconds of an inch, and called for further investigation. This was made, and it was found that the white metal pads of the thrust block had failed and thus permitted the serious axial displacement of the rotor. Timely stoppage by the attendant in this instance saved what might easily have been an exceedingly serious smash.

The fourth case was that of a 1250-kW steam turbine of the impulse type, made in 1916. Whilst it was at work under normal conditions this machine suddenly developed unusual vibration, necessitating immediate shut-down. The turbine was opened, and examination showed that one of the turbine wheels was badly fractured almost half across its diameter. This involved the fitting of a new wheel complete with blades. Here again the prompt action of the attendant was the means of averting a nasty smash. Had this wheel burst at its running speed of 3000 revolutions per minute the consequences would have been of an extremely serious nature.

SIXTY YEARS AGO.

Sixty years ago war had been declared between France and Prussia. In this country no one knew how the situation would develop or what its reaction on our trade and prosperity would be. Would Russia join the conflict? Would Great Britain be able to remain neutral? Would the German ports be blockaded? If we succeeded in keeping out of hostilities, would we have an opportunity of supplying France and Prussia with ships and war material and of carrying on a trade similar to that which a few years previously we had conducted with the combatants in the American civil war? Uncertainty, excitement, and anxiety existed in all our markets. It was too early for us to offer any opinion of our own as to the effect which the war would have on this country. In the introduction to an article describing the manner in which the Prussians had converted a large number of smooth-bore bronze "battering guns" and "guns of position" into breech-loading rifled guns, we had, however, some comments to make which clearly reveal the feelings as to the merits of the combatants which generally prevailed in this country. France, with its at least nominally democratic government, was for the most part regarded with much more favour than Prussia, the government of which was avowedly despotic. We spoke of Bismark as being an unscrupulous bully, but we had to admit that he had ruled Prussia always with great and national aims in view, and that his name would for ever live gratefully in the memories of all Germans. He was a despot, but we uttered a sigh for the efficiency with which all despotisms spent their taxpayers' money, so far as munitions of war were concerned. We contrasted with Bismark's rule the doings of our own constitutional Government, which leaked gold in all directions. Our ministers were encumbered, like a rock with limpets, by placemen, personal friends, and political wirepullers. Despotism, we said, did not place orders for impossible models of 35-ton guns, nor did it cut down noble trees and spoil a park to help a half-private hobby for the sake of securing political support. The reference was to Sir Joseph Whitworth and his transactions with the Government. As we have previously noted, we were hotly opposed to the Whitworth system of artillery, and with a freedom which we would scarcely now permit ourselves in similar circumstances, had asserted that the Government's encouragement of Sir Joseph had its origin in the political influence which he had it in his power to command in the Manchester area. As for the converted Prussian guns, our opinion was not favourable to their value in war. We remarked, however, that they would not be found in service in the Prussian Navy or for the defence of Kiel. Almost unknown and silently, Prussia had been preparing a powerful fleet in the Baltic. For its use she had wrenched the harbour of Kiel from Denmark. The armament provided for her war vessels and coast defences consisted, we revealed, not of converted bronze guns, but of new breech-loading guns of steel.

Railway and Road Matters.

IN this column on November 15th last mention was made of the determination of the New Zealand Minister of Railways to close unprofitable branch lines. In a cable in *The Times* of July 3rd that paper's Wellington correspondent says that the Minister had announced an extensive curtailment in the services, including the discontinuance of numerous passenger trains and the closing of several branch lines.

THE Southern Railway Company has added two paddle steamers to its fleet—the "Southsea" and "Whippingham"—which have been built by the Fairfield Shipbuilding and Engineering Company, Govan, for service on the Isle of Wight route between Portsmouth and Ryde. The new vessels are 50ft. longer than the boats at present on the service; they have a speed of 16 knots and can carry 1183 passengers—674 first-class and 509 second-class.

THE Ministry of Transport railway statistics for March showed also the results for the first three months of the year as compared with the corresponding quarter of 1929. The number of passengers paying full fare fell off by 7·73 per cent., but the number carried at cheap rates increased by 10·66 per cent. It is satisfactory to note that the number travelling at workmen's fares rose by 4·04 per cent. The receipts from passengers decreased by 6·70 per cent., mainly owing to fewer full-fare journeys. The tonnage of goods traffic was down by 2·01 per cent. and the receipts by 0·79 per cent.

A POINT in Colonel Trench's report on the Culgaith collision of March 6th that we had not space to deal with in our editorial comments on July 4th was that, as anticipated in this column on June 6th, that officer agreed with the railway company that there was no reason to criticise the driver and fireman for the fact that the latter was driving the engine. Colonel Trench remarked that "Actual experience in handling a train is evidently the only way a fireman can become qualified for promotion to driver, and in this case . . . I do not see any reason to consider the procedure objectionable or unreasonable."

AN inquiry of the Minister of Transport on July 2nd as to passengers falling from trains whilst in motion led Mr. Morrison to reply that the total number of accidents to persons falling out of railway carriages during the running of trains during the last five years amounted to between nineteen and thirty-five persons killed and between forty-two and fifty-one persons injured in each year. The liability of accident from this cause is about one in every 20,000,000 passenger journeys. It is not possible to say what proportion of these accidents might have been prevented by the use of a different type of door fastening. The matter is continually under review.

ONE of the cases of serious accidents to railway servants investigated during the quarter ended September 30th last related to the necessary protection of a gang of painters who were working on a bridge that spanned two down lines. Mr. Moore, one of the Assistant Inspecting Officers, placed the blame for the accident on the negligent manner in which the lookout man performed his duties. He added that the method of protection was, however, wholly inadequate and not in accordance with the rules. The ganger disregarded the rules in their entirety and was deserving of severe censure. It was to be regretted also that his neglect in this respect, which extended over a fortnight, passed unnoticed and ultimately led to an accident.

THE report for the year ended March 31st, 1929, of the Indian Railway Board says that at the end of that year about 150 of the new standard locomotives were in use on broad and metre-gauge railways. Reports received were very satisfactory, and the anticipated reduction, as compared with the original B.E.S.A. standard engines, in maintenance cost and fuel consumption was becoming apparent. It is further observed that the B.E.S.A. unilateral gauging system had been adopted as the standard practice for locomotive work, and all future locomotives would be built to the tolerances stipulated under the provisions of that system. A large number of standard fittings have been incorporated in the current superheater conversion and reboilering programmes.

THE reorganisation of railway workshops is aggravating the housing problem in many places. In discussing a resolution on that point at the annual general meeting of the National Union of Railwaymen on July 8th, Mr. Cramp, the industrial secretary, said that 150 men were removed from Ashford to Lancing. They were unable to obtain housing accommodation, and if they went home to their families at the week-end they had to lose time and wages because the train service did not allow them to resume work at the proper hour. It was unfair to the railwaymen, and in some senses to the railway companies, that housing accommodation did not exist. The Ministry of Health could not help them; the remedy lay with the local authorities to use the powers they possessed.

ACCORDING to the Board of Trade returns, the value of the railway material exported during the first five months of the present year was as follows; the corresponding figures for 1929 and 1928 are added in brackets:—Locomotives, £1,517,316 (£1,292,764, £1,614,547); rails, £1,038,284 (£1,254,720, £1,645,332); carriages, £731,894 (£824,711, £1,234,673); wagons, £1,400,309 (£1,181,663, £1,539,655); wheels and axles, £140,167 (£183,507, £414,006); tires and axles, £316,037 (£232,950, £256,695); chairs and metal sleepers, £349,240 (£208,918, £437,269); miscellaneous permanent way, £382,903 (£474,054, £633,633); total permanent way, £2,287,858 (£2,420,516, £3,455,342). The weight of the rails exported was 118,003 tons (149,623 tons, 189,786 tons), and of the chairs and metal sleepers, 37,610 tons (21,015 tons, 44,548 tons). During the month of May last the value of the locomotives shipped overseas was £273,783, and included:—India, £109,453; Straits Settlements, £36,793; South Africa, £30,030; Ceylon, £6460; Australia, £6103; the Argentine, £5811. The rails exported in May were of the value of £142,286, and included:—South Africa, £26,620; the Argentine, £23,703; New Zealand, £12,393; Straits Settlements, £9645; Ceylon, £2928; British West Africa, £1587.

Notes and Memoranda.

THE Powerton power station of the Super Power Company, Illinois, has an average sustained economy of 12,455 B.Th.U. per kilowatt-hour sent out. The capacity of the plant is 110,000 kW.

THE output of metallic magnesium in the United States amounted to 1,329,669 lb. during 1929. It was obtained almost entirely from the magnesium chloride of the brine wells at Midland, Michigan.

A NEW scheme of concentrating gold ores is to be tried out at the Porcupine mines in Ontario. About 97 per cent. of the coarse ground ore is to be treated by the flotation process, when reduced to a 60 mesh, which is expected to produce a concentrate of 13 per cent. of the ore.

THE Rio Grande in Texas has changed its course by cutting through a narrow neck of land separating two bends of the river. As a consequence, the intake of the water supply for Brownsville has been left almost dry. The problem now facing the municipal authorities is whether it would be preferable to utilise the river's discarded bend as a settling pool or to extend the intake pipe to meet the new course of the river.

THERE is a rather quaint passage in the will of the late Clement Herschel, who left a considerable part of his property for scientific purposes. He stated, among other things, "I know well the argument that groping, even aimless, research must precede applied science; but have found that practical inventions more often precede their scientific explanation; while aimless research only too often results in nothing better than having its printed record encumber the shelves of libraries."

IN order to make the annual report of the National Physical Laboratory more convenient to subscribers, it is being published by H.M. Stationery Office in seven separate parts. The report on the Physics Department is priced 2s.; that on the Electricity Department, 3s. 6d.; on the Metrology Department, 2s.; on the Engineering Department, 2s.; on the Aerodynamics Department, 2s.; on the Metallurgy Department, 1s. 6d., and of the Advisory Committee for the William Froud National Tank, 9d.

JUST what may happen to a steam turbine between the time of shipment and delivery is recounted as follows in *Power*. The Georgia Power Company, building a 60,000 kW steam generating plant near Atlanta, Ga., had reached the point of construction where installation of the 60,000 kW turbine was the final important step. The General Electric Company shipped the turbine, and the engineers made preparations to receive and unload it. When, however, the car containing the rotor was being hauled over the Seaboard Air Line Railway, the front truck jumped the track about 9 miles from Tucker, Ga. The rotor was eventually heaved overboard and the blade wheels were buried in the clay. It speaks volumes for the construction of the modern turbine that after the rotor had been shipped back to the factory and tested none of the blades was found to be loose.

A RADICAL decrease in the number of Canadians with special scientific training who seek work in other countries is shown by the records of the Dominion universities. In the immediate post-war years, when greater opportunities were offered in the United States, many young Canadians with special technical training found employment in the United States. With the rapid increase in Canada in engineering, construction, mining, power development, and so forth, the field of opportunity for men with technical training has become comparatively broader than it is in the United States, and not only has the percentage of university graduates who migrated to the United States or other countries fallen from 27 per cent. in 1925 to 3 per cent. in 1929, but there has also been a considerable return movement of this and every other class of Canadians from the United States during the past few years.

AT a recent meeting of the Institute of Fuel, Dr. C. M. Walter said that in Birmingham they were trying to ascertain load factors of some large consumers of gas in order to find out whether it would pay to install gasholders. There were a few cases in which the use of gasholders by consumers would undoubtedly pay them, and if certain firms, whose load factors were very poor, would combine in erecting the holders, it would help very materially. As an example, there might be a consumer A having a very good load factor, followed later by another consumer B in the same area of supply with a very poor load factor. The result was that B would upset the supply of gas to A, and then the gas supply authority had to spend more money on mains in order to maintain a satisfactory supply to both A and B. If the gas could be stored in a holder, and if B would use gas from that holder during times of peak loads, the supply authority might save a considerable amount of capital expenditure.

AN interesting addition to the Royal United Service Museum, Whitehall, is one of the links of the "mightie chaine of yron" which formed part of the early defences of Portsmouth Harbour. The chain was made to be buoyed up across the mouth of the harbour by means of three barges and it is mentioned in a Navy Account, presented in February, 1522, as having been constructed at a cost of £40. The value of money was much greater in those olden times. From ancient records, however, it appears that the chain was not put into use until 1545, and for a number of years prior to that date it was probably lying on the bottom of the sea at the mouth of the harbour. When, about 100 years later, another chain was made, the original one was left in the mud, and until recently the shore end could be seen at low water, to the south of King Edward's Tower. A little time ago the President of the Staffordshire Iron and Steel Institute suggested recovering some of the links with a view to subjecting them to metallurgical examination. This was done, and one of the links, measuring 3ft. 8in. by 14in., was presented to the Royal United Service Museum, but, as it had been cut for the purpose of removal, before it was put on exhibition it was repaired by the Barimar welding process and restored to the condition it was in when it was removed from the water.

Miscellanea.

AN effort is being made to find a site for an aerodrome at Bombay.

A GRAIN storage elevator with a capacity of 1,000,000 bushels, is to be erected at Lethbridge, Alberta.

OF world newsprint exports in 1929, amounting to 3,851,000 tons, Canada exported 2,511,000 tons, or 65 per cent.

A NINETEEN-STOREY high building is being put up at Dallas, Texas, and is claimed to be the tallest structure fabricated by the arc-welding process.

THE Congella power station of the Durban Corporation is to be extended by the addition of a new 12,000 kW turbo-alternator and two more boilers.

TWO new and important deposits of potash have been found in a French region situated on the Upper Rhine about 6 miles north of St. Theresa mine, near Oberhergheim.

A FORTY-FIVE-FOOT motor lifeboat has been supplied to the Bombay Port Trust by J. Samuel White and Co., of Cowes. She is propelled by twin engines of 40 horse-power each and has a speed of 8¼ knots.

WORK is to be started immediately on a hydro-electric power plant at Rapide Blanc, Quebec. It is to have an ultimate capacity of 240,000 horse-power, developed from a fall of 110ft. The cost of the plant is estimated at 83 dollars per horse-power.

AN official committee has been organised by the Canadian Government to investigate the possibilities of a ship canal across the isthmus at Chignecto, which would reduce the voyage from the south into the St. Lawrence by at least 200 miles. The length of the canal, if it is made, will be no more than 15 miles.

THE monthly return of the National Federation of Iron and Steel Manufacturers shows that the number of furnaces in blast at the end of June was 133, a net decrease of eight since the beginning of the month, nine furnaces having been blown out and one having commenced operations. The production of pig iron in June amounted to 563,200 tons, compared with 614,500 tons in May and 657,800 tons in June, 1929. The production includes 171,700 tons of hematite, 227,900 tons of basic, 122,300 tons of foundry and 21,900 tons of forge pig iron. The June output of steel ingots and castings amounted to 600,100 tons, compared with 691,900 tons in May and 830,900 tons in June, 1929. Part of the decline, in the case of steel, is due to the Whitsun holidays.

THE French Merchant Marine Commission has pronounced favourably on the Bill declaring the works of improvement and extension at the port of Boulogne to be in the public interest. These works have become necessary owing to the continual development of the port, which, situated at about equal distances from Paris, Brussels and London, is a natural centre for commercial and passenger traffic. The proposed improvements and extensions will allow of a more rational use of the port, which plays a triple part being a great fishing port, a port of call for Transatlantic boats and a transit station for passengers coming from or going to England. The new plan for the port includes the lengthening of the Carnot dam, the construction of a dam to the north converging towards the Carnot dam, the building of a jetty at the bottom of the landlocked roadstead, and the creation of large open land spaces. The cost of these works is estimated at nearly 400,000,000f.

THE production of metallic cadmium in the United States in 1929 amounted to 2,481,427 lb., valued at 2,009,956 dollars. This is an increase of 32 per cent. in quantity over the production of 1,875,896 lb. in 1928, which was 75 per cent. higher than production in 1927. The average value reported by producers in 1929 was 81 cents a pound, compared with 61 cents a pound in 1928. There were 214,307 lb. of cadmium, valued at 184,527 dollars, imported into the United States during 1929, compared with 233,101 lb., valued at 128,901 dollars in 1928. There were five producers of metallic cadmium in 1929. In addition to metallic cadmium, domestic manufacturers reported production of the following cadmium compounds in 1929:—Cadmium sulphide, cadmium sulphate, cadmium hydrate, cadmium oxide, cadmium chloride, cadmium acetate and cadmium lithopone. The estimated cadmium content of cadmium compounds produced was 433,300 lb., valued at 498,734 dollars, in 1929, compared with 239,900 lb., valued at 228,013 dollars, in 1928.

THE report of the Conference between the members of the Canadian Section of the Joint Board of Engineers and representatives of the Ontario Hydro-electric Commission, who have been investigating the navigation and power possibilities of the international section of the St. Lawrence River, recommends double-stage seaway and power development to cost 274 million dollars. The report is mainly a compendium of information to enable the Dominion and Ontario Governments to make their decisions in the light of the engineering problems involved, but the recommendations are definite in respect of the practicability and cost of the project. While differing in minor respects, the report mainly agrees with the recommendations advanced by the Canadians in their conference with the United States section of the Joint Board, some years ago, which recommendations were embodied in the report published in 1926. A double-stage development is again recommended with an upper dam and power-house to be built at Cryster Island and lower similar works at Barnhart Island. This scheme would entail, according to the report, less land flooding and less embankment construction than would be involved in a single-stage project with dams and power plants concentrated at Barnhart Island, which was recommended by the United States *personnel* of the Joint Commission. The Canadian project would flood the village of Iroquois and one-third of the town of Morrisburg, necessitating the rebuilding of Iroquois on a new site. The report recommends the removal of houses from the flooded section of Morrisburg and the raising of the area above the river level, the reclaimed land being turned into a park.

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(*For description see page 58.*)

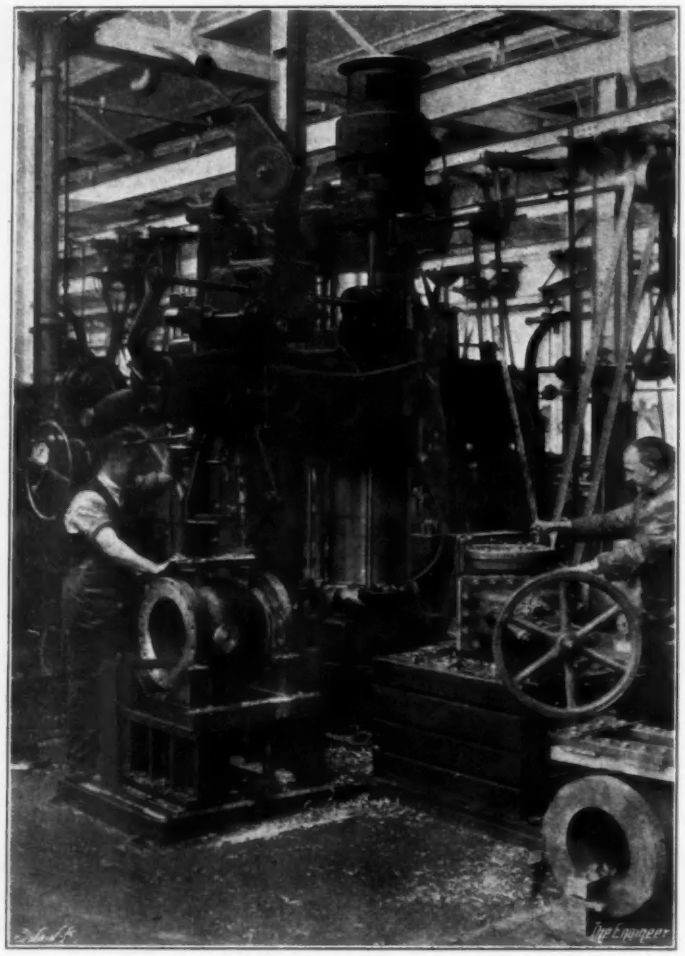

FIG. 5—DRILLING VALVE FLANGES

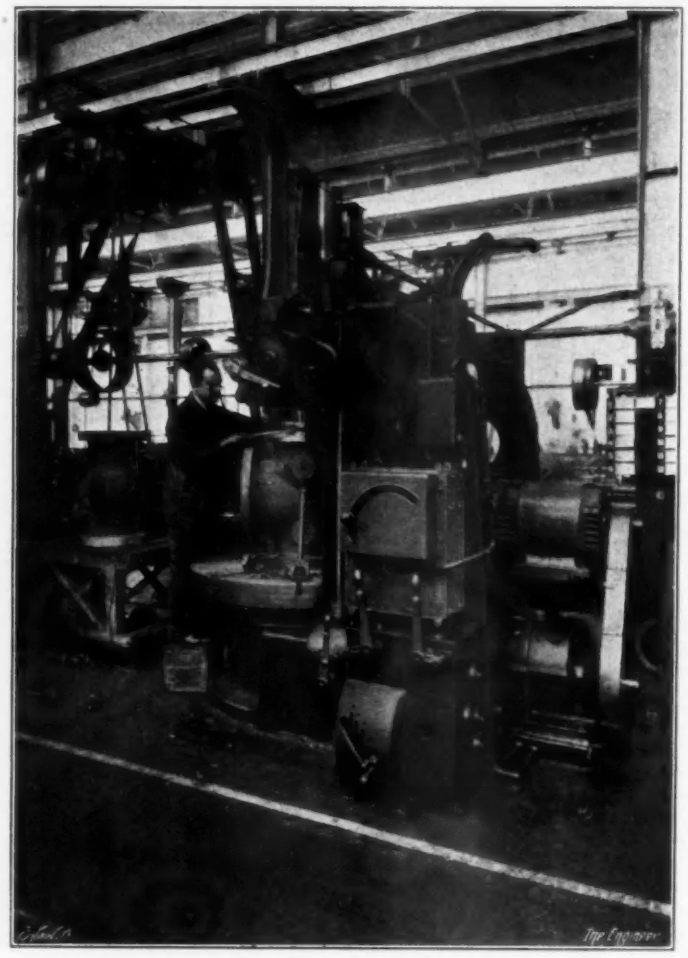

FIG. 6—ELECTRICALLY-DRIVEN BORING MILL

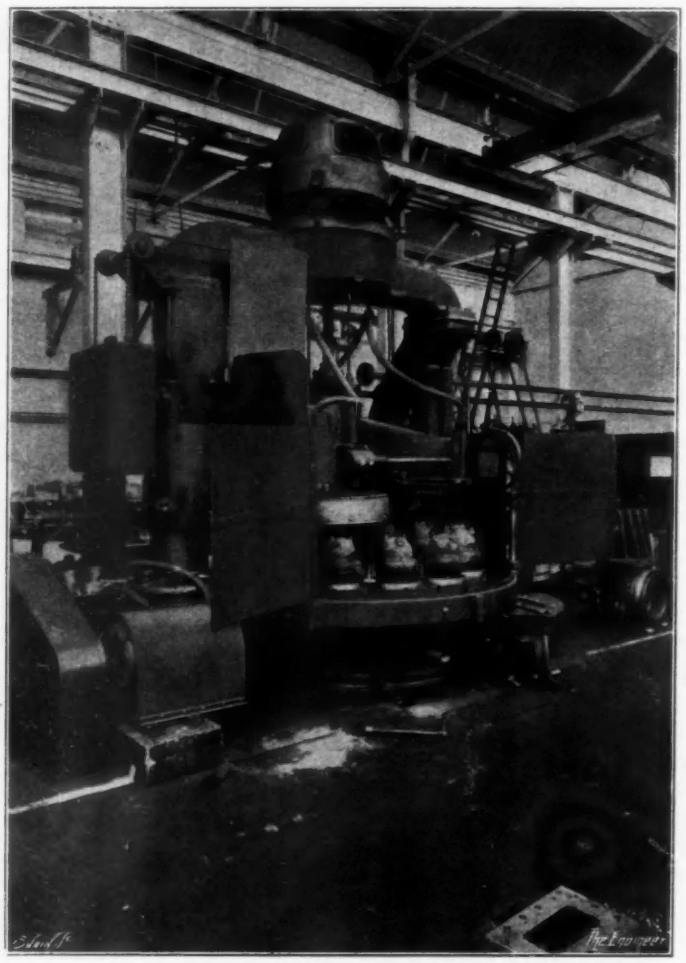

FIG. 7—LUMSDEN GRINDING MACHINE

FIG. 8—HOLROYD MULTIPLE DRILLING MACHINE

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THE ENGINEER.

VOL. CL No. 3888

JULY 18, 1930.

The World's Electricity Supply.

THE Power Conference held in Berlin has served to focus the attention of the public generally on the subject of electricity supply. Throughout the world endeavours are being made to encourage people to use electricity, and in certain parts satisfactory results have been secured. Although electricity will not solve all the social problems or bring happiness and prosperity to the people of the world as a whole, it is pretty well agreed that no country that desires to hold its own as an industrial nation can afford to ignore the fact that as far as possible power must be substituted for manual labour. Given a supply of electricity, manufacturers can take full advantage of power and augment their output, but the supply must be cheap. Similarly in the home, on the farm and elsewhere. cheap electricity is useful. For the most part, the civilised world is now alive to the benefits to be derived from electric power, and although the greatest progress has been made in the United States, other countries are making rapid strides in the way of extending and expanding their systems of generation, transmission, and distribution.

The position as regards the consumption of electricity throughout the world at the present time is set forth in a pamphlet recently issued by Pynchon and Co., of New York, a firm that has been identified with the financing of many important undertakings and which seems to have an inner knowledge of what is happening in all parts of the globe. The production of electricity throughout the world at the present time is shown to be well in excess of an annual rate of 300,000,000,000 kilowatt-hours, and the United States is contributing 1 kilowatt-hour for every 1·4 kilowatt-hours generated by all other countries. Germany ranks second among the nations in the amount of electricity produced, with an estimated output of 34,000,000,000, or about 11 per cent. of the total generated; Canada producing over 18,000,000,000 kilowatt-hours is third in the line, furnishing about 6 per cent. of the total; whilst Great Britain and France appear to take fourth place, each with approximately 16,000,000,000 kilowatt-hours per annum. How much money is invested in the world's electric power plant is, of course, largely a matter of conjecture, but it is believed to be something like 25,000,000,000 dollars, or £5,000,000,000. In the United States the average consumption per head of the population now exceeds 813 kilowatt-hours annually, against 450 in Germany and 350 in Great Britain from all sources. Canada, with a relatively small population and an enormous hydro-electric development, has a per capita consumption for all purposes averaging 1845 kilowatt-hours. What is regarded as the world's highest consumption per resident is reported from Winnipeg, where 3741 kilowatt-hours are reached, this city using large quantities of electricity for house and water heating and cooking. The pamphlet covers fifty-one countries, including Russia, which has a scheme in hand consisting of a great network of central stations and transmission lines reaching out to industrial towns and rural communities throughout the country. Railway electrification has progressed furthest in Switzerland, where, taking advantage of extensive water powers, over 60 per cent. of the total mileage is electrified. In Austria 8 per cent. of the total mileage is electrified, and 6 per cent. in Italy, but how railway electrification stands in the remainder of the countries the compilers of the pamphlet do *not* say. While, as everyone knows, and as the pamphlet indicates, electrical development in Great Britain is in a relatively backward state, the conditions are steadily improving, both as regards output and operating efficiency. Even in countries where the total consumption is much greater than it is in Great Britain there is room for much improvement in certain directions. In Germany, for instance, only 10 per cent. of the current sold is used for household purposes. Whilst discussing industrial electrification in his presidential address delivered before the Institution of Electrical Engineers in 1928, Colonel Edgcumbe compared the degree of industrial electrification or the ratio of electric to total installed horse-power in this and other countries, and showed that in all classes of engineering the degree of electrification in Great Britain was excellent. In electrical engineering this country had a slight advantage over the mean of America and Germany, and still more so in the shipbuilding and wool trade, but in all other industries it lagged behind. Taking the degree of industrial electrification for each country as a whole, Great Britain showed 48 per cent., Germany 67 per cent., and the United States 73 per cent. It is clear, therefore, that Great Britain has a great deal of leeway to make up in the electrification of industry. Similarly in the domestic field this country is a long way behind other countries, such as the United States, where there is said to be an average annual consumption per residential consumer of 516 kilowatt-hours, representing an increase of 10½ per cent. over the consumption a year ago. Whilst such a high rate of consumption may be very satisfactory from the supplier's point of view, it does not necessarily imply that the people of America are usefully absorbing that amount of electricity. The waste of current is far greater in that country than this, and economists are presented with the interesting result that it pays the country to be extravagant, because the price of production appears to fall as the consumption rises.

Further progress in the consumption of electricity in this and other countries should be accompanied by progress in other directions, both on the commercial and technical sides. The various forms of rates or tariffs, power factor clauses, and so forth are, in our opinion, obstacles to progress, and an endeavour should be made to sell electricity on a more rational basis. Whilst it must be admitted that conditions vary from place to place and from country to country, and that the fixing of rates is a somewhat difficult matter, it, nevertheless, seems that some of the complicated schemes for charging for electricity ought to be abolished. On the technical side of the electricity supply business improvements are, of course, constantly being made, particularly as regards the consumption of fuel. In America the average coal consumption is said to be 1·63 lb. per unit generated now, as compared with 3·2 lb. in 1919. It is well known, however, that the price of electricity is governed very largely by factors outside the power-house. Cheap electricity throughout the world cannot be secured merely by reducing the consumption of fuel. Transmission, distribution, metering, collecting, and the maintenance of the service ready for instant use enter very largely into the price the consumer pays for current. On the transmission and distribution of electricity an

immense amount of money is being spent, and every effort should be made to minimise the outlay. Technical problems that present themselves in this business of the world's electricity supply are invariably more or less satisfactorily solved, but often at considerable expense. By linking up large and powerful power stations, for instance, engineers have set themselves the task of dealing with enormous short-circuit currents. Large and costly circuit breakers have therefore been provided, but it is doubtful if this practice will always be considered correct. Rather than perpetuate this old system, which was satisfactory in bygone days, an endeavour should be made to limit the duty that can be imposed on circuit breakers. We are aware, of course, that work has been carried out along these lines, but there appear to be opportunities for further study and development. While supply undertakings are rapidly increasing in size and enormous outputs now have to be dealt with, there is a tendency in all parts to modify old designs to make them meet the new conditions rather than to depart entirely from antiquated ideas. In order that the people of the world may be served with electricity to the best advantage, the inventor and research worker must be allowed to develop their ideas, even if they threaten to result in radical changes in present-day practice.

Trade Problems Abroad.

THE new American tariff is something more than an incident in the industrial situation. It is a climax to a state of things that has been growing in complexity for a long while past, and it marks the culmination of a movement that will either produce important changes in international trading relations or will end in disaster. All continental countries have been awaiting with anxiety the fate of the American tariff proposals. Now that they are adopted, and manufacturers and producers see that an important market is closed to them, the question of European solidarity arises afresh. Will there be an international defensive movement or national reprisals? In Belgium it is proposed to denounce the "most favoured nation" clause with the United States. In France the Commission des Douanes recommends the Government to do the same thing, if all attempts at conciliation fail, and in Italy, Switzerland, and other countries the situation is being discussed with a view to acting on the defensive. In France the effect of withdrawing from the United States the privilege of the most favoured nation treatment would be to apply to that country the maximum tariff, which is practically prohibitive. There are, however, questions of policy that make Governments hesitate to enter upon a direct conflict with the United States. Reprisals may be more likely than not to stiffen the American attitude. It has even been stated in America that Continental countries have brought the tariff on themselves by strengthening their own protection to the extent of excluding American goods. There are certainly other reasons for the tariff, but the explanation given, coupled with the fact that President Hoover has the power to reduce import duties by 50 per cent., at least shows the possibility of the tariff being used as a lever to obtain facilities for trade in Europe. It is not easy to see how that object can be attained under present conditions. Now that industries have been built up everywhere under cover of protection, the interests involved are so great that the chances of anything being done to clarify the situation are remote, at least until a crisis weeds out industries, the existence of which is inimical to greater national interests. The cause of all the trouble is the desire of most Continental countries to sell all they can abroad and take little or nothing in return, in the belief that an unfavourable "balance of trade" is a cause of impoverishment. There can be no hope for the future until those countries that aim at becoming self-supporting see that they cannot support themselves without an exchange of goods and products.

The idea of a European economic union has not made progress, for obvious reasons, but it has loomed once more out of the menace of the American tariffs. It is significant that the creation of a European Federal Customs Union is under discussion. It is asked, Why should Europe not be self-supporting? Why should Europe not produce all the grain it needs instead of purchasing from the United States? There is no reason, it is now said, why money should not be spent upon stimulating the production of wheat on the Continent. But in the light of all that has happened in the past, a self-supporting Europe is an illusory ideal, and is only possible with the removal of fiscal barriers under conditions which would absolutely assure universal peace. The problem has been thrashed out so thoroughly by the committees at Geneva and elsewhere, without any practical solution being arrived at, that the chances of creating a European commercial union are small. All countries may be at one on large issues, but they are unable to agree on smaller matters. In every case there is resistance from some countries whose interests are not identical with those of others. Now that agricultural countries have become industrial and industrial nations are seeking to develop agriculture, they are all competing with each other, and national interests have become so involved that it is extremely difficult to settle upon international trading agreements. The fear that the new tariffs have closed the United States market to European goods and products has demoralised many branches of continental industry, because there does not seem at present to be any way out of the difficulty. Manufacturers are waiting to observe the effect of the tariffs upon trade with America, and they are meanwhile investigating every means of extricating themselves from an intricate situation. Turn where they will, they see no means of developing trade, except by adopting heroic measures to force themselves on foreign markets, by paying bounties, for example, on the export of agricultural produce and granting special facilities for exporting manufactured goods. A foreign trade cannot be satisfactory when it is not carried out under normal conditions.

There is an impression on the Continent that with their prohibitive tariffs the United States will suffer from an inflation of prices, with a consequent increase of wages, that will place that country in a less favourable position for doing a foreign trade. Whether that is likely to be the case or not, it is argued that one way of countering the protectionist move is to bring down prices on the Continent. The former French Prime Minister, Monsieur Herriot, states that the present difficulties can be met by a reduction of wages and a lowering of selling prices. In his own words, it is "a matter of life or death." Therefore, the American tariff has strengthened the movement in favour of wages reduction, which began in Belgium and Germany, and has been accepted in France as a possible contingency, though, until this new argument was forthcoming in favour of reducing wages, it did not seem likely that any real effort would be made to adjust the wages anomalies. In the French labour market the supply is often below the demand. Nevertheless, it is clear that the movement is spreading, and how far it will extend will depend upon the export trade. A solution of the problem is limited for the moment to the alternative of constituting a European Federal Customs Union or of increasing consumption and forcing goods into ultra-protectionist countries by bringing down selling prices. The Customs Union encounters at present almost insuperable obstacles, although by patient negotiation it may, in the end, produce good results. The only immediate remedy is the lowering of the cost of goods and commodities, and this is not merely a matter of economic policy, but a natural outcome of a surplus production for which markets must be found.

Literature.

Weetman Pearson, First Viscount Cowdray. By J. A. SPENDER. London: Cassell and Co., Ltd. Price 21s.

THIS is the life story of an exceptional man, written in an exceptionally able manner. Throughout the volume there are ample evidences that it comes from the pen of one who was not only intimately acquainted with the subject of the memoir, but who also had for him a deep admiration. The reader is thus given a vivid picture of the great contractor, who owed his success in life quite as much—if, indeed, not more—to his courageous nature, to his capacity as a financier and as an organiser and to his capability of taking pains, as he did to his skill as an engineer. If the picture is painted in somewhat vivid colours, there is much justification, for Weetman Pearson, from very early in his business career, was an outstanding figure in the field of contractual engineering.

The work is divided into twenty-four chapters, to which are added four appendices and an excellent index. In the first chapter, entitled "The Beginnings," we have a brief outline of the starting of the firm of S. Pearson and Son, of Bradford, and of the boyhood of young Weetman Dickinson Pearson—he derived both his Christian names from his mother, whose maiden name was Sarah Weetman Dickinson—who, his biographer is at pains to point out, had not entirely to make his own way in life. His grandfather, Samuel Pearson, though, as he, himself, used to say, he was no scholar, was an astute man of business and quite well-to-do when his son George—the father of Weetman—was born. When old enough, George was taken into partnership with his father and the firm prospered, so that he—George—was well able to give his son Weetman a good education, albeit it ended when he was but sixteen. So the lad, we are told, did not have to fight for a start in life; there was a business ready for him to step into, and almost immediately on leaving school he had to fill responsible posts.

From Chapter II., which is headed "The Junior Partner," we learn that when he was hardly twenty-one years of age—that is, when he had had less than five years' experience—"he was entrusted with the personal superintendence of one of the firm's most important contracts, that for the construction of a new main drainage system for the town of Southport in Lancashire. In after days he was in the habit of describing this as one of the toughest jobs he had had in all his life. The greater part of Southport is built on sand, and to provide a durable bed for sewers in its shifting subsoil, much of it sodden with water, was a task of uncommon difficulty, which might have tested the most experienced engineers. But already he had the temper which welcomes a challenge, and he faced up to this one with the zest of youth. His father came to the rescue in extreme emergencies, but for the most part left him to grapple with the difficulties in his own way, and when finally they were overcome, the credit was mainly his." That is characteristic of the note which the author strikes throughout the book. He likes to dwell upon the pluck, self-reliance, pertinacity and initiative of the man about whom he is writing.

In 1879, when Weetman was just twenty-three, we are told, his grandfather went out of the business and gave him his share. It is not specifically so stated, but we gather from a remark made later in the book, that the monetary value of that share was some £20,000. "He thus became his father's sole partner in the Firm of S. Pearson and Son, and as successor to his grandfather had his own independent interest in it." Notwithstanding that he had this advantage of a place ready made for him, "he was," says Mr. Spender, "nevertheless, to an immense extent the maker of his own fortune and that of the Firm. In a talk I had with him about his early life, a few years before his death, he told me that as soon as he became a partner he had immediately to face the fact that the Firm had an overdraft at its bankers largely in excess of what he considered to be warranted by its assets and prospects. In this sense he started from scratch, and his first years were years of intense and anxious work to maintain the credit of the Firm and to lay a solid foundation for the future. Next to starting a new business, there is no more formidable task than that of pulling an old one out of a rut, and this fell to the young Pearson in his twenty-fourth year."

It so happened that recovery depended on the profitable handling of two contracts, one for the construction of a main drainage scheme at Ipswich, and the other for a dock at King's Lynn. Of both, young Weetman undertook the personal superintendence, and managed so well that "after two years of this work he saw his way clearly ahead . . . and the unsleeping junior partner had his plans laid for developments further afield." In 1881 took place "the most important event of his life"—his marriage with Annie Cass, the daughter of Sir John Cass, of Bradford. Of the success of that union the book has much to say, and it says it delightfully, but we must pass over it, for space will not permit us to deal with anything more than what we are told concerning the business man and the contractor.

The successes at Ipswich and King's Lynn also determined the young man—he was but twenty-six—to do something which he had evidently contemplated for some time, namely, launch out further afield. "The Firm was to cease to be a local one; it was to claim its place among the great national contracting firms and bid boldly for big business all over the world. . . . He saw no reason why his horizon should be bounded by Yorkshire and the Eastern Counties." So, in 1882, he successfully tendered for the work of constructing the Deptford storm outfall sewer for the then Metropolitan Board of Works. "This in itself," writes Mr. Spender, "was no great matter, but it placed him definitely on the London map, and two years later (1884) he took the step which had long been in his mind, of transferring the headquarters of the firm from Bradford to London. The first London office was in Delahaye Street. . . . After the move to London the young Pearson was to all intents and purposes head of the Firm, 'the chief' of subsequent years, and his father was well content that he should be." The father, it appears, "took his work lightly, and liked to travel and enjoy himself. When his son was still in his teens he would depart suddenly and leave him to get in the money and pay the wages and wind up the week's work. The son always spoke with admiration of his father's ingenuity and resourcefulness, when he chose to apply himself to business, but their temperaments were so different that friction between them was inevitable, and the younger man was often galled by his father's sarcasms."

At any rate, it came about that after the removal to London George Pearson, though he also came south and bought property at Brickendonbury, in Hertfordshire, "faded into the background" while his son went ahead. As far as the Firm itself was concerned, however, the move to the Metropolis had the most satisfactory results. We are told by the author that, in the five years after it had established itself in London, it obtained contracts all over the world and young Pearson travelled widely and rapidly between one and another. "Success," writes Mr. Spender, "was now continuous and unbroken, even overwhelming, and within five years Pearson was in the highest flight of his own business and becoming widely known as a man to be reckoned with. . . . But this prosperity had to be bought with incessant and exhausting toil. He did everything himself, down to the smallest detail; his wife furnished the office rooms and they spent their Saturday afternoons together at Delahaye Street tidying up after the staff had gone. For eight years he took no holiday, and was often so exhausted that when the Bank Holidays came he went to bed and slept through them."

In 1894 Pearson was created a baronet, "in those days counted signal promotion for a young man who only ten years earlier had come to London to seek his fortune." In the same year he bought the estate of Paddockhurst in Sussex, the property of Mr. Whitehead, of torpedo fame, and "all the time that he could spare out of London or from his incessant business journeys during the next seven years he spent at Paddockhurst with his wife and children, and very often a houseful of guests. No sooner was he in possession of this estate than he was at work altering, planning, levelling, developing, making ponds and lakes, installing new water supplies or shifting old ones. There were times when his estates seemed for long periods to be the scene of extensive public works. But he and his wife together made beautiful gardens, and many of his happiest hours in these years were spent in these occupations at Paddockhurst."

We might go on, almost indefinitely, giving quotations which throw intimate light on the character and personality of the man who was to become first Viscount Cowdray. Enough, however, has, we think, been adduced to show conclusively how eminently suitable to be his biographer is the author of the present volume.

Regarding the many other chapters in the book, we can do little more than enumerate their titles. To give even a brief outline of their contents would mean the filling of many pages of THE ENGINEER. It must suffice to say that they are full of interest and that they disclose data and particulars which, so far as we are aware, have never been published before. The chapters on "Financing the Business" and "The Methods of the Contractor" will well repay a close study, while that entitled "Member for Colchester" shows how that Weetman Pearson was always in rebellion against the time-wasting ways of the House of Commons, "and never could be what is called a good House of Commons man. Whenever business and politics conflicted, politics, unless the necessity of his vote and presence was absolutely proved, went to the wall. Yet, outside his business and his home, politics remained to the end his chief interest in life."

Of chapters describing some of the outstanding contracts carried out by the Pearson firm there are those dealing with:—"The Hudson Tunnel," "The Blackwall Tunnel," "The East River Tunnels," "The Mexican Grand Canal," "The Vera Cruz Harbour," "The Tehuantepec Railway," "Dover Harbour," "Exploring for Oil," "The Oil War in Mexico," "Revolution in Mexico," "Undertakings and Experiments," and "The Sennar Dam," all of which provide fascinating reading. Then, too, the chapters entitled "Reverses and Successes," "Hopes and Fears," "The Secrets of Success," and "Last Days" all cast further illuminating sidelights on the late Lord Cowdray's personal character, while much in the same connection may be learned from the chapters concerned with "Activities in War-time," "President of the Air Board," and "Coal and Newspapers."

Of the appendices, the first contains a list of the works carried out by S. Pearson and Son, Ltd., with the dates and—in the majority of cases—the amount of the contract sum. Appendix II. is a reprint of Lord Cowdray's Rectorial address delivered to the students of Aberdeen University on October 22nd, 1920. It is entitled "Labour: Its Problems and its Ideal Wage," while Appendix III. gives the reply, prepared by his lordship before his death, to the speech which the Lord Provost had intended to deliver in presenting the Freedom of Aberdeen. The presentation was to have taken place on May 3rd, 1927—two days after Lord Cowdray's death—and his reply was printed in the *Aberdeen Press* on the morning of May 3rd.

In conclusion we may well, we think, give a quotation from the preface, for it explains to a great extent the point of view from which he regarded his subject and the spirit in which he wrote the biography. Moreover, it is a delicate pen picture of the man about whom he has written. He says:—"And perhaps, as I am writing of an old friend, I may be allowed to say that the 'capitalist' revealed in these records presents none of the features commonly assigned to that type in current controversy about social systems. He is not over-reaching or grasping; he is careful and considerate of his workmen; he has from first to last no quarrel of his own with any body of them or any trade union; large numbers of them come time after time long distances to obtain employment from his Firm. In his dealings with those who employ him he never seeks to amend a contract or evade its conditions when they prove unfavourable; he never takes advantage of weakness or ignorance to secure gain for himself. In undertakings of great magnitude he relies, not on legal guarantees or the letter of the law, but on his own confidence that as he treats others fairly, so they will treat him. If he made a great furtune for himself he gave in return the best he was capable of giving and has left a record which proves that fair dealing and good workmanship still have their reward."

It is a good book; well written and well got up. We have read it with sustained interest, and we feel sure that many others will do likewise.

SHORT NOTICES.

The Barrister. By Sir Harold Morris, K.C. Life and Work Series. London: Geoffrey Bles. 1930. Price 3s. 6d.—This is one of a series of books sufficiently defined by the general title. It has given us some anxiety. Sir Harold Morris, who is known to engineers as the President of the Industrial Court, shows us life at the Bar in such charming guise that we feel it almost our duty to discourage the circulation of this volume lest it should divert young men from engineering. Fortunately, training for the Bar is a costly business, and success takes long in coming. Sir Harold mingles humour and wisdom into such a delightful salad that once begun we go on till the dish is finished. Whether one wants to become a lawyer, or, being a lawyer, likes to hear all about his profession, or, being a mere engineer, desires to know how barristers justify their existence, this is the book to read.

A Critical Review of Literature on Amplifiers for Radio Reception. Price 5s. London: H. M. Stationery Office, Adastral House, Kingsway, W.C. 2.—The review and general bibliography of the more recent literature on the design of radio receivers, contained in this report, have been prepared at the National Physical Laboratory on behalf of the Radio Research Board, with the object of indicating the lines along which future research may be profitably undertaken. To bring out the relative importance of the different sections the review is essentially critical, and all the papers cited have been examined from this point of view. The review is divided into four sections: (*a*) Radio frequency amplifiers; (*b*) rectification; (*c*) audio-frequency amplifiers, and (*d*) measurements. Critical comments expressing the compiler's views on a paper are given at the end of the abstract and are inset to distinguish them from the purely abstracted portion. In the compilation of the review many publications have been consulted, and the volume should prove of considerable value to those interested in the development of amplifiers for radio reception.

Design of Electrical Apparatus. By John H. Kuhlmann. London: Chapman and Hall, Ltd. Price 30s.—Complete design calculations are given in this book for two direct current machines, two synchronous machines, two induction motors, and four transformers. The volume also contains a great deal of general information on electrical design. The procedure adopted for each type of machine discussed is, first, to explain the construction of the machine to be designed, then to explain the formula and procedure and to give the design limits established by practice, and, finally, to give an illustration with complete calculations. The book is apparently intended mainly for students who desire to become electrical designers and who have already mastered the elementary principles of electrical engineering. In view of the fact that the book is not confined to one particular class of machine, such as direct current generators, it should appeal to a much wider range of readers than many other books on electrical design, especially as it covers transformers.

BOOKS RECEIVED.

Mine Atmospheres. By W. Payman and I. C. F. Statham. London: Methuen and Co., Ltd., 36, Essex-street, W.C. 2. Price 10s. 6d net.

Modern Bridge Construction. By F. Johnstone Taylor. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. 4. Price 15s. net.

How to Form a Company. Nineteenth edition. By H. W. Jordan. London: Jordan and Sons, Ltd., 116, Chancery-lane, W.C. 2. Price 2s. 6d. net.

American Petroleum Refining. Second edition. By H. S. Bell. London: Constable and Co., Ltd., 10, Orange-street, W.C. 2. Price 31s. 6d. net.

The Handy Hotel Guide, 1930–31. London: The Hotel and General Advertising Company, Ltd., Temple House, Tallis-street, E.C. 4. Price 6d. net.

A Study of the Induction Motor. By F. T. Chapman, D.Sc., &c. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 21s. net.

The Magneto Manual. Second edition. By H. R. Langman. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. 4. Price 7s. 6d. net.

Zur Frage der Beanspruchung beim Dauerchlagversuch (Stress at Repeated Impact Tests). By Dr.-Ing. S. Berg. Berlin: V.D.I. Verlag G.m.b.H., Dorotheenstrasse 40.

Public Works Department, Madras Presidency: Administration Report, 1928–29. Part II., Irrigation. Madras: The Superintendent, Government Press. Price Rs. 2-8-0.

Forschung und Technik: im Auftrage der Allgemeinen Elektricitäts-Gesellschaft. By Professor Dr.-Ing. W. Petersen. Berlin: Julius Springer, Linkstrass 23/24, Berlin, W. 9. Price 40 marks, net.

Henley's Twentieth Century Book of Ten Thousand Recipes, Formulas and Processes. Edited by G. D. Hiscox. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. 4. Price 16s. net.

Failures of Railway Materials, Dealing Chiefly with Ferrous Metals. By E. A. Wraight and P. Hinde. London: Office of the High Commissioner for India, 42, Grosvenor-gardens, S.W. 1. Price 5s. 3d. net.

A Comprehensive Treatise on Inorganic and Theoretical Chemistry. Volume X.: S,Se. By J. W. Mellor, D.Sc., F.R.S. London: Longmans, Green and Co., Ltd., 39, Paternoster-row, E.C. 4. Price 63s. net.

The Issuing House Year Book and Financial A B C, 1930. Compiled by the Institute of Commercial Research, Ltd. London: The Institute of Commercial Research, Ltd., 20, Copthall-avenue, E.C. 2. Price 21s. net.

The Place of Engineering Science in University Studies. An Inaugural Lecture delivered before the University of Oxford. By R. V. Southwell. London: The Oxford University Press, Amen House, Warwick-square, E.C. 4. Price 2s. net.

Report of the British Acetylene Association to the Tenth International Acetylene Congress held at Zurich, July 9th to 12th, 1930, on the Progress of Oxy-acetylene Welding and Cutting in the British Empire. London: The British Acetylene Association, 12, Russell-square, W.C. 1. Price 7s. 6d. net.

Lloyd's Register Shipbuilding Returns.

FROM the statistics issued by Lloyd's Register of Shipping regarding vessels under construction at the end of June, it is noted that in Great Britain and Ireland there is a decrease of 222,930 tons in the work in hand as compared with the figures for last March, and that the present total—1,392,063 tons—is 61,843 tons less than the tonnage which was being built at the end of June, 1929. About 58,000 tons of the tonnage now in hand in this country are intended for the British Dominions; about 292,000 tons for Norway; and about 232,000 tons are for other foreign shipowners or for sale. The tonnage now under construction abroad—1,665,672 tons—is 14,736 tons greater than that which was in hand at the end of March, 1930, and is the highest since 1921. Five countries abroad have more than 150,000 tons under construction, viz.:—United States, 238,163 tons; Germany, 237,468 tons; Holland, 187,445 tons; France, 186,960 tons; and Russia, 156,621 tons. The total tonnage under construction in the world amounts to 3,057,735 tons, of which 45·5 per cent. is being built in Great Britain and Ireland and 54·5 per cent. abroad. The average percentages in the last twelve months before the war were 57·2 for Great Britain and Ireland and 42·8 for abroad. In Great Britain and Ireland 230,466 tons were laid down, a decline of about 196,000 tons from the similar figures for the March quarter; and 468,023 tons were launched, an increase of about 123,000 tons. Similar figures for abroad are 350,425 tons commenced and 418,853 tons launched. A large increase as compared with the previous quarter is again shown in the tanker tonnage under construction, the present figures being 148 vessels of 1,110,056 tons, of which 84 vessels of 633,577 tons are being built in Great Britain and Ireland, and 16 vessels of 142,845 tons in Germany. It is significant that of the 148 tankers under construction, 131 are motor ships. The tanker tonnage now being built represents over 36·5 per cent. of the total steam and motor tonnage under construction in the world and is the highest on record. As was the case at the end of March, the tonnage of motor ships now under construction in Great Britain and Ireland exceeds that of steamers being built, the present figures being 831,159 tons and 556,804 tons respectively. The motor ship tonnage being constructed abroad—1,089,346 tons—is more than 94 per cent. greater than the tonnage of steamers. The continued progress in the employment of the internal combustion engine for the larger vessels is indicated by the fact that while there are now being built in the world 91 motor ships, each of 8000 tons and upwards, only 30 steamers of such size are under construction. These figures include 10 motor ships and 11 steamers, each of 15,000 tons and upwards. The table respecting marine engines shows that the horse-power of steam engines now being built or being fitted on board amounts to about 980,000 while the figures for oil engines aggregate about 1,430,000 The figures for steam engines include 53 sets of of turbine engines of about 554,260 shaft horse-power, giving an average of nearly 10,500 horse-power per set. The tonnage actually under construction throughout the world under the inspection of Lloyd's Register reaches 1,977,628 tons, of which 1,176,030 tons are being built in Great Britain and Ireland.

Obituary.

J. P. CLARK.

WE regret to have to record the death on Monday, July 14th, of Mr. J. P. Clark, one of the senior engineers of the Marconi Company. Mr. Clark entered electrical engineering as a student at Faraday House, where he passed out as a Prizeman. He was then engaged for some years in electrical engineering in Yorkshire before he joined the Marconi Company in 1913. For a number of years past Mr. Clark was chief of one of the contract sections in the Engineering Department of Marconi House, and as such was responsible for the provision of the plant and supplies to many of the largest wireless telegraph stations in all parts of the world, particularly the Marconi wireless beam stations which have been erected not only in Great Britain, the Dominions and India, but in other countries. In the successful establishment of these stations Mr. Clark's work was of great importance and his services were highly valued. Mr. Clark's death took place suddenly, while on holiday, and came as a great shock to his many friends in Marconi House, where he was held in very great esteem.

POWER-HOUSE AND HEAT ENGINE LABORATORY AT UNIVERSITY COLLEGE, NOTTINGHAM

(*For description see opposite page.*)

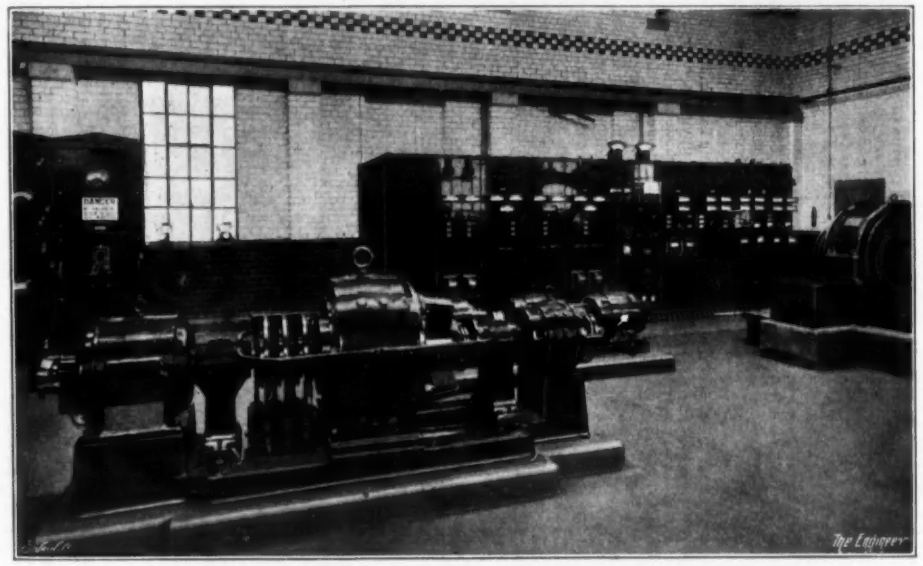


FIG. 1—ROTARY CONVERTER AND SWITCHBOARDS IN POWER-HOUSE

FIG. 2—OIL ENGINE DRIVEN GENERATOR SET IN POWER-HOUSE

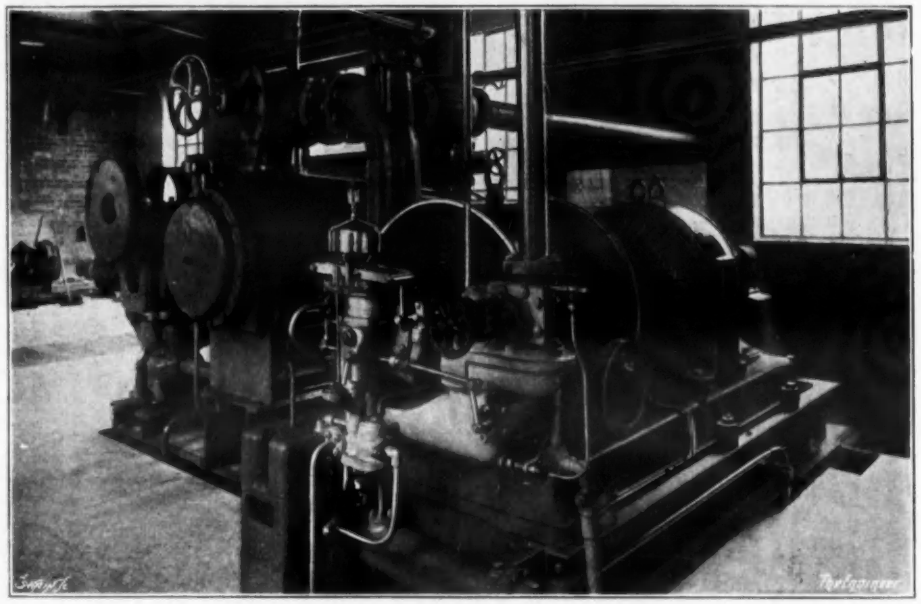


FIG. 3—TURBO-ALTERNATOR SET IN THE LABORATORY

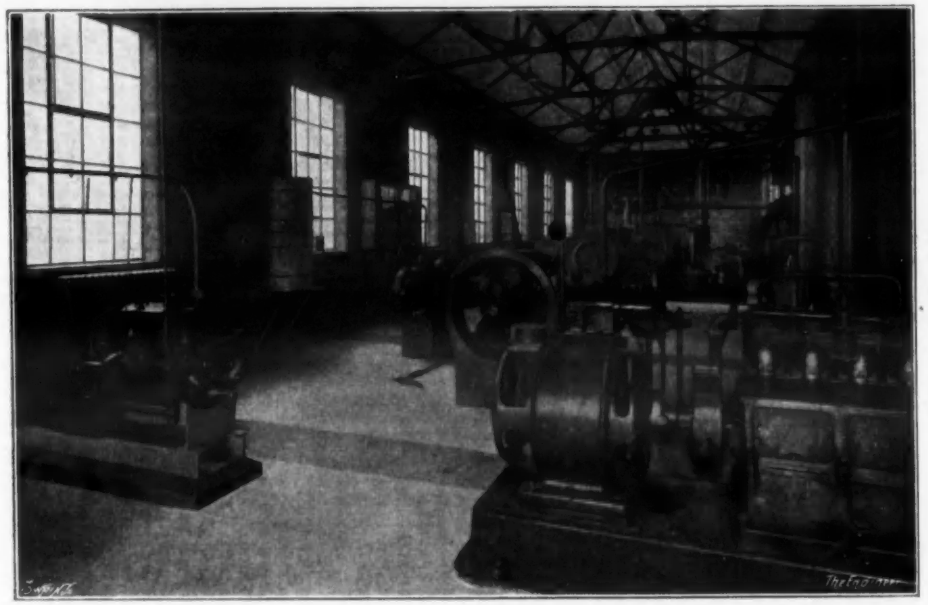


FIG. 4—HEAT-ENGINE LABORATORY

New Engineering Laboratories at University College, Nottingham.

As recorded in a Journal note of our last issue, the new engineering laboratories at University Park, Nottingham, were formally opened on Wednesday afternoon, July 9th, by Brigadier-General G. M. Jackson, D.L. In the following article we refer to the chief points of technical interest in the laboratories, and illustrate some of the principal machinery for power production and distribution which we have recently personally inspected.

For many years past the work of the Engineering Department at Nottingham University College has been carried on in the buildings of the old University College in Shakespeare-street, where extensive and well-equipped laboratories for instruction in mechanical, electrical, civil and mining engineering have been built up. When the building of the new University College on the Highfields Estate, together with all the other amenities of university life which go to make up University Park, was proposed by Sir Jesse Boot, now Lord Trent, it was not intended to have an engineering department. About that time, however, the Engineering Department received offers of one or two very valuable pieces of apparatus and machinery for which no possible room could be found in the old buildings at Shakespeare-street, and Lord Trent readily agreed to the setting apart of buildings to house these gifts.

FIG. 5—NEW UNIVERSITY COLLEGE AT UNIVERSITY PARK

As our illustration—Fig. 5—shows, the new University College, which was built to the designs of Mr. Morley Horder, is pleasantly situated on a slope, with a lake in the foreground, and is set amidst and against a spreading group of trees, with terraces below. It was specially desired that the new engineering laboratories, with the necessary power plant, should not mar in any way the landscape beauty of University Park. They were, therefore, built at the back of the main college buildings, and the power-house chimney is well masked by trees.

As a certain amount of boiler plant was needed for heating and domestic services and the power and lighting supply was met by a sub-station taking current in bulk from the 11,000-volt high-tension circuit of the Nottingham Electricity Department, it was wisely decided so to arrange the power-houses and heat engine laboratories that all the plant was available for complete testing by advanced students, thus forming a valuable part of the course in the training of a power station or power production engineer, such as is not usually available at universities and university colleges.

The new engineering laboratories comprise the boiler-house and the power station, a heat engine laboratory, having a length of 100ft. with a breadth of 23ft., and a second laboratory of similar dimensions, which is now serving as a builders' workshop, but will shortly be available for instructional service. A future scheme provides for an extensive electrical laboratory alongside the power-house, a civil engineering laboratory with a drawing-office above it, and an adjoining block of new buildings with appropriate class-rooms and lecture theatres. This scheme when completed will form a very compact and convenient group of laboratory buildings. The boiler-house, a view of which is reproduced in Fig. 6, is sunk below the ground, and there are underground coal and coke bunkers. Such an arrangement avoids the necessity of too high a chimney and is also convenient for the college heating system. The heating and domestic hot water services are provided for by an installation of four Robinhood heating boilers and a 100 lb. Cochran boiler. The heating system, we noted, was supplied by F. Pullen and Co., Ltd., of London. This plant is shown to the extreme left of Fig. 6. In the centre of the same view will be seen a Babcock and Wilcox water-tube boiler, with its chain grate stoker, which was presented by the makers. It has a designed working pressure of 200 lb. per square inch with an output of about 2500 lb. of steam per hour. The grate area is 22 square feet and it is served by a 2ft. 7in. by 8ft. 6in. chain grate stoker. Both forced and induced draught systems are available, and a Lea coal meter with a feed recorder, a Mono CO_2 recorder and other auxiliary fittings for complete boiler trials are provided. Alongside these is a Thompson water-tube boiler of 1700 lb. per hour capacity, also presented by its builders, which is at present arranged for hand firing. It works in conjunction with a Clay Cross economiser, and again all the necessary instruments and auxiliaries for testing are included in the equipment. Arrangements are now being made to adapt the furnace of this boiler for both oil firing and for powdered fuel working.

Typical power-house views are reproduced in Figs. 1 and 2, opposite. The Nottingham Electricity Department sub-station comprises G.E.C. cubicles for the 11,000-volt circuit, together with a Ferranti transformer, and a 150 kVA transformer for College service and testing is also available. In order to convert the high-tension current to 440-volt D.C. supply for the College, three-wire distribution system, there is a 150 kW Mather and Platt rotary converter with an exciter which can be run inverted for experimental purposes. It also has one armature coil, at a tapping point, wound with high resistance conductors, which are brought out to two auxiliary slip rings. By this means oscillograph records of current wave form and field form can be taken. This plant is shown in Fig. 1, along with the eleven panel distribution switchboard by J. H. Holmes and Co., Ltd., of Newcastle, which is seen in the background. Another interesting piece of plant is a Ruston and Hornsby 84 B.H.P. heavy-oil engine, coupled direct to a Holmes 40 kW D.C. generator with a static balancer, which set is shown in Fig. 2. The engine has a bore of 14½in. with a stroke of 20in. and develops its output at 210 r.p.m. It was used to provide power and light during the building of the University College, and the set is now available for peak load service. Very complete provision has been made for testing the engine and generator, and the auxiliary testing equipment can be attached at short notice. Other plant in the power-house includes a balancer booster set, by Mather and Platt, Ltd., and other auxiliary equipment. At the present time a 50 kW mercury-arc rectifier equipment is being installed, and the important circuits will be brought out to a link board, so that this apparatus will be also available for testing. Alongside the main power-house is a battery room with a Pritchett and Gold, 440-volt, 330-ampère capacity battery, which is used for night loads. The glass cases of the cells are large enough to carry additional plates, which, when added, will increase the capacity of the battery to 500 ampère hours. In the electrical laboratories at Shakespeare-street there is a large number of electrical machines of the latest types with very complete testing apparatus, including a Duddell oscillograph and insulating testing plant.

In the two lower views opposite, we show the new test engine laboratory. One of the main items is a 75 B.H.P. B.T.H. turbine—see Fig. 3—with a 60 kW, 440-volt alternator and condensing plant. The turbine and generator was presented by the British Thomson-Houston Company, Ltd., of Rugby, and Worthington-Simpson and Co., Ltd., of London and Newark, gave the condensing plant. The turbine operates at 215 lb. steam pressure and runs at 1500 r.p.m.; a surface condenser with a centrifugal circulating pump and an Edwards type air pump is provided. The electrical output is controlled by a Park Royal Engineering Company switchboard, and a water resistance for testing the load is arranged outside the laboratory. The cooling water is supplied by a spray pond on the roof of one of the buildings, and a Kent Venturi meter is provided for measuring the flow. We also noted an Electroflo steam meter with a recorder and integrator.

The smaller steam plant includes a Ruston-Hornsby horizontal 7in. by 10in. steam engine. The internal combustion engines, which are shown in Fig. 4, comprise a 12 B.H.P. National gas engine, working in conjunction with a Campbell gas producer; a four-cylinder Dorman petrol engine, with a Heenan and Froude hydraulic brake; a Potter two-stroke, 4¼in. by 4¼in., 600 r.p.m. paraffin engine, and an Austin house lighting set coupled to a Siemens Bros. generator. The laboratory includes working benches and a small workshop with machine tools. Practically all the plant to which reference has been made was presented by its manufacturers or by private donors, and has been erected by the staff and the students.

In carrying through the new engineering laboratory scheme, Professor C. H. Bulleid, M.A., A.M. Inst.C. E., M.I. Mech. E., the head of the Engineering Department, and his assistant, Mr. J. M. Dickson, B.Sc., A.I. Mech. E., also Dr. H. Cotton, M.B.E., M.Sc., A.M.I.E.E., the Director of the Sub-department of Electrical Engineering, who is assisted by Mr. E. W. Golding, B.Sc., A.M.I.E.E., worked in conjunction with an advisory committee, including a number of influential engineers connected with local industries. As a result of the appeal which was made, apparatus of £6000 in value has been presented, to which the University College Council added a sum of money of about £1000, which was made during the war in conjunction with the College work in munition training. The scheme we have outlined, and the beginning which has been made with the new engineering laboratories, will greatly facilitate the work of the University College in the training of engineers for power stations and industrial power plants, and we hope that before long it will be found possible to complete the scheme referred to. We would express our thanks to the gentlemen above-named for the facilities they have given us in the preparation of this article.

FIG. 6—THE BOILER-HOUSE

INTERVENING in a discussion on workmen's compensation at the annual meeting of the National Union of Railwaymen on July 10th, Mr. Marchbank, the assistant general secretary, said he wanted to state publicly that so far as compensation cases were concerned, the most admirable arrangements existed between the railway companies and the union, and very few difficulties arose except when there were conflicting decisions in the Courts.

The Economics of Cargo Liners.*

By the Hon. L. H. CRIPPS, C.B.E.

THE primary object of a cargo boat is to convey cargo from one port to another at which it is required in the condition in which it is required. The success of a cargo boat will depend on how efficiently she can perform that service; broadly, that is to say, how cheaply she can give to her clients the service they require. It is wasteful to provide a service either above or below actual requirements; but so long as we maintain a competitive system we shall find, by trial and error, that is by success or failure, whether our methods as a nation generally or as shipowners individually are adequate to maintain our national and individual position in the sea-carrying trade of the world. The interest to naval architects will be in the consideration that the most successful nation will probably remain the main manufacturing centre for shipbuilding, as has been the case in the past.

Probably the most important point in designing a cargo liner is that of speed. A shipowner running ships in a regular trade to a more or less fixed schedule requires the maximum efficient speed for the type of cargo he expects to carry. The task of the designer is to provide for an increase in the speed at the lowest possible capital cost, and ensure that upkeep expenses resulting from a new design shall be no more and, if possible, less than normal, whilst taking advantage of anything he can to increase the carrying power of the ship, *e.g.*, the supercharging of a Diesel engine, where you get about 30 per cent. additional S.H.P. for 8 per cent. increase on the initial cost of the machinery.

The question of speed still appears to be a very ill-defined problem, complicated by its interdependence on the engineer and the naval architect. The different types of engines, the lines of the ship, the propeller and the rudder give curious and sometimes incomprehensible results when actually tried out.

The type of engine to be provided is probably at the moment the most difficult question for the shipowner to decide. There has been such great progress in the last twenty years both in steam-driven and internal combustion engines that the selection is difficult. The main points for consideration in cargo liners are:—Speed required; trade in which the vessel is to run; average number of steaming days per annum; cost of various fuels in the various ports visited; machinery, weight, and H.P. ratio; space required for machinery. With regard to the last point, the decrease in length of machinery space is shown by the following comparison of three ships built during the last eight years. All the ships have a similar beam and twin-screw eight-cylinder oil engines of the same cylinder diameter.

Date of construction.	S.H.P. of machinery.	Length of engine-room.
1922	4800	63ft.
1926	6600	60ft.
1929	8600	54ft.

In considering the various types of engine the most attractive are those combining absolute reliability with simplicity of design, with the reduction as far as possible of labour for running the ship at sea and during overhaul and surveys in port. The shipowner's desire is to maintain a reliable service and not to indulge in experiments, except perhaps in a small way to improve an existing design; nor does he wish to have a whole lot of patented accessories, most of which in the long run show an increased cost in spite of a theoretical promise of large savings. I do not know whether naval architects and marine engineers realise the enormous cost of upkeep. I have been told by a shipbuilder that such and such an engine is running well, and on one such occasion I had an opportunity of seeing the actual upkeep costs for that particular engine. Instead of working out at, say, x for 200 days' steaming per annum, it worked out at just about twice as much. I often wonder if a shipbuilder is sufficiently interested in any engine after he has delivered it to the owner. On working results, in fact, he must base future design, and the most successful design will presumably be developed out of the maximum of accurate information.

It will be of interest if I give a few figures of engine costs taken out for our fleet for the last ten years, except in the case of Diesels, which range from one year to eight years. I have included ships good, bad, and indifferent, taking the saturated steam triple-expansion engine at the basic figure of 100. The figures are shown in Table II. These figures are not meant to be more than a rough guide on certain types of engines, and apply only to long-distance trades. They may interest you as they show the comparative amounts spent on engine upkeep and engine stores.

The design of the hull so far as speed is concerned is prepared by the naval architect, and no trouble should arise here if the model is tank tested; but the strength of the ship must be such that—subject to safety—the cargo, whatever its nature, can be carried without damage, having regard to the seas in which the ship trades. The ultimate success of the design will be tested by the upkeep costs and cargo claims.

As to the quality of materials, there has been little or no recent progress, due perhaps to the fact that the metallurgist is not in sufficiently close touch with the naval architect, or perhaps to some want of enterprise on the part of steel manufacturers; the position in this respect remains almost stationary.

A third point is the design of the loading and discharging facilities provided to deal with the cargo expeditiously, enabling the ship to obtain reasonable dispatch at her ports of loading and discharge.

A fourth point is the housing of the crew. The shipowner has to depend largely on the men who work the ship, generally hundreds of miles away from the management, for the efficiency of the work they are constantly carrying out. To get the best results the men must be happy and contented, and they must have a ship which is reasonably comfortable and which can be loaded and discharged under ordinary conditions without recourse to long hours of overtime. A time may come when crews are largely dispensed with, and when engineers are reduced to a minimum; but at present the problem has to be met on the most economical lines possible, bearing in mind the general efficiency of the ship.

Another point is the effect of the rules and regulations enforced by the Board of Trade. Such rules are necessary and wise in so far as they are really reasonable, but the reasonableness of some of them is a matter of opinion. I feel that we are very near the time when further rules and regulations may simply end in shutting us out of the carrying trade of the world.

I won't leave the subject of design without saying something about bad workmanship. No one who has been through the experiences of the last ten years can fail to realise the heavy cost of bad workmanship. While recognising the intrinsic excellence of British workmanship, there are, nevertheless, cases where bad riveting has cost shipowners thousands of pounds. Another expensive defect, the cause of which I suppose to be bad workmanship, is not uncommon in turbine engines, where results in practice often bear no relation to promises. In our case we have already re-engined no less than two of our turbine vessels and renewed the gearing in another. In one case it was, perhaps, in part, faulty design, which I recognise must sometimes occur wherever there is progress, as, after all, while design is a matter of opinion, experience alone shows whether the opinion is right or wrong.

There are no doubt a great many other factors in design, but I return to the question of upkeep, which cannot, as you will see, be divorced from design. My object in dealing with it is to show how important a bearing it has on design. Upkeep falls under three main headings: the engines, the hull, and the effect of the engines on the hull. The general rules of upkeep are:—(1) That the simpler the machinery or structure, the less the cost of upkeep, and any complications introduced must individually pay for inclusion and for upkeep; (2) standby and emergency machinery or structure is generally nearly as expensive in upkeep as the regular plant; (3) good original workmanship and design is of extreme value in reducing the cost of upkeep.

Engine upkeep can be reduced appreciably by close collaboration with the metallurgist, *e.g.*:—Getting the right quality of lubricating oil for bearings, liners, &c.; putting into the machinery material of the very best quality to stand the requisite loads, temperatures, and stresses; using fuel oil most suitable for the boiler or Diesel installation, &c.

A large proportion of the total cost of upkeep of oil engine machinery has been due to defects of detail rather than to fundamental defects. The material of liners, cylinder heads, pistons and piston rings is of the utmost importance, and the introduction in recent years of a special iron which provides, not only a material of very suitable quality for these parts, but one which may be consistently produced, has, in conjunction with improved detail design, much reduced upkeep costs. Unfortunately, in order to increase the running reliability of oil engines, changes in design have been made which, whilst good for this purpose, have tended to reduce accessibility of parts and increase the amount of work necessary to open up for survey. Engine builders might well give this matter more attention, especially as it will become increasingly important in specifications issued by shipowners.

With the increasing use of electricity comes the cost of repairs and renewals to wiring and standby plant as against the cost of maintaining the steam plant, steam and exhaust pipes, &c., of the all-steam system, with the consequent damage to the structure of the ship due to corrosion, &c. In my figures on engine upkeep I have excluded such large costs as renewing turbines. You will see from the upkeep records that we have generally found the four-stroke cycle single-acting Diesel engine to be the most economical type among those we have tried for our particular trades.

TABLE I.—*Relative Cost in Percentages to Carry 7000 Tons Cargo 100 Miles.*

Ship.	Class of machinery.	Fuel.	Average. S.H.P.	Average. Fuel efficiency. Actual coefficient / Theoretical coefficient	Average. Speed.	Fuel cost in Percentages to carry 7000 tons cargo 100 miles. At average speed.	Fuel cost in Percentages to carry 7000 tons cargo 100 miles. Reduced to common basis of 13½ knots.
				Per cent.		Per cent.	Per cent.
"Atreus"	Single-screw reciprocating, saturated	Coal	3,343	92·57	12·62	86·0	100·0
"Keemun"	Twin-screw reciprocating, saturated	Coal	3,269	85·03	11·68	77·5	105·3
"Lycaon"	Single-screw reciprocating, superheated	Coal	4,091	96·18	13·08	77·4	82·3
"Antilochus"	Twin-screw reciprocating, saturated	Coal	3,429	93·28	11·98	66·6	86·6
"Æneas" (passenger)	Twin-screw reciprocating, superheated	Coal	4,669	86·8	13·40	98·0	98·8
"Nestor" (passenger)	Twin-screw reciprocating, superheated	Coal	5,928	93·25	13·46	94·1	94·8
"Adrastus"	Single-screw turbines, superheated	Coal	4,895	94·07	13·97	86·3	80·7
"Phemius"	Single-screw turbines, superheated	Oil	4,683	88·25	13·93	109·0	102·2
"Polydorus"	Single-screw turbines, superheated	Oil	3,813	97·8	13·38	94·3	95·8
"Calchas" (intermediate passenger)	Twin-screw turbines, superheated, old engines	Coal	5,776	81·9	13·66	97·2	96·6
"Calchas" (intermediate passenger)	Twin-screw turbines, superheated, new engines	Coal	5,556	100·8	13·83	77·6	76·1
"Menelaus" (intermediate passenger)	Twin-screw turbines, superheated	Coal	5,547	98·3	13·41	77·8	79·2
"Sarpedon" (passenger)	Twin-screw turbines, superheated	Coal	7,369	93·52	15·08	118·8	95·2
"Antenor" (passenger)	Twin-screw turbines, superheated	Oil	7,424	93·9	14·97	131·0	106·8
"Peisander"	Twin-screw Diesel	Oil	3,787	98·42	13·03	42·2	45·3
"Orestes"	Twin-screw Diesel	Oil	5,160	97·6	13·77	48·9	47·1
"Agamemnon"	Twin-screw Diesel	Oil	5,190	102·6	13·83	49·8	47·3
"Dolius"	Twin-screw Diesel	Oil	2,071	89·29	10·70	27·35	43·5
"Medon"	Single-screw Diesel	Oil					

TABLE II.—*Relative Costs of Ship Upkeep, Ship's Stores, Engine Upkeep, and Engine Stores in Percentages.*

Ship.	Class of machinery.	Fuel.	Speed, knots.	Displacement in tons.	Designed S.H.P.	Number of ships in class.	Average age, years.	Relative costs. Ship upkeep.	Ship stores.	Engine upkeep.	Engine stores.
								Per cent.	Per cent.	Per cent.	Per cent.
"Atreus"	Single-screw reciprocating, saturated	Coal	13	13,500	4,000	5	19	100	100	100	100
"Keemun"	Twin-screw reciprocating, saturated	Coal	12	18,300	5,500	3	28	143	112	105	110
"Lycaon"	Single-screw reciprocating, superheated	Coal	13½	15,000	4,400	8	15	80	100·1	105	112
"Antilochus"	Twin-screw reciprocating, superheated	Coal	12½	18,900	4,500	5	24	147	130	122	116
"Æneas" (passenger)	Twin-screw reciprocating, superheated	Coal	13½	19,400	5,000	3	20	178	88	197	165
"Nestor" (passenger)	Twin-screw reciprocating, superheated	Coal	13½	26,800	6,000	2	17	198	88	234	171
"Adrastus"	Single-screw turbines, superheated	Coal	14½	15,200	6,000	8	8	75	97	96	112
"Phemius"	Single-screw turbines, superheated	Oil	14½	15,200	6,000	1	8	79	99	64	107
"Polydorus"	Single-screw turbines, superheated	Oil	13	12,600	3,700	2	5	53	90	61	95
"Calchas" (intermediate passenger)	Twin-screw turbines, superheated	Coal	14	20,800	6,500	4	7	108	125	193	147
"Sarpedon" (passenger)	Twin-screw turbines, superheated	Coal	15	19,400	7,500	2	7	162	131	183	202
"Antenor" (passenger)	Twin-screw turbines, superheated	Oil	15	19,400	7,500	2	5	161	123	134	167
"Peisander"	Twin-screw Diesel	Oil	13	12,600	3,700	5	4	56	84	65	161
"Orestes"	Twin-screw Diesel	Oil	14½	15,300	6,600	4	3	68	92	87	197
"Dolius"	Twin-screw Diesel	Oil	11	11,400	2,200	2	6	49	92	88	162
"Medon"	Single-screw Diesel	Oil									

* Summer meetings of the Institution of Naval Architects, July 15th, 1930. Abridged.

The trades concerned entail a high percentage of steaming time and command a supply of cheap oil.

I have shown in Table I. a fuel efficiency figure, and the discount on this figure may show bad design or bad operating, but it is difficult to say which. Probably it is more often the result of bad operating, such as the purchase of inferior fuel or excessive economy in renewals and replacements.

The statistics given relate to ships of various ages and are consequently only a rough guide, as the upkeep in the newer ships is naturally less than in the older ships, and we have yet to ascertain what is in fact the probable length of life of the newer types.

In figures on the upkeep of the hull, which include all money expended on the hulls except emergency fitting for carriage of special cargo, cattle, &c., you will notice that the oil-burning ships show at the moment similar results to the coal-burners, except in the case of the "Phemius" class of vessel; but this result is due to their being originally fitted for coal burning with the consequent re-riveting necessary on the change over—a result very different from engine upkeep cost, where the oil burners come out a great deal cheaper. Incidentally, where fuel oil and water are carried in the tanks the deterioration of the steel is exceptionally severe. Coal, on the other hand, has produced continual deterioration in the stokehold bunkers, 'tween decks, also deck machinery, and affects the amount of painting to be done. In considering the relative cost of oil or coal fuel, I think that this side of the question has not been sufficiently investigated. It is certainly a very difficult matter on which to obtain accurate information.

Another most interesting point is whether a heavier ship is more costly in upkeep than a lighter ship, or putting it another way, what scantlings will give the highest efficiency in any given trade? Here again information is difficult to obtain.

The most serious problem of upkeep in itself is rust. When are we to have a rustless ship just as we have rustless knives? The enormous cost to shipowners of chipping and painting would, if it could be done away with, create a new epoch in shipping costs and, as it stands, offers probably the greatest opportunity for increased efficiency in the industry.

The last important point in upkeep is the accommodation. As machinery becomes more efficient, when painting is done away with and when steering becomes automatic, the crew will be very materially reduced in number, and with them can be reduced the numerous life-saving devices and accommodation, making room for extra cargo and saving wages and food.

Turning to depreciation, we have one of the most difficult problems the shipowner has to meet. When is it sound policy to scrap a ship? It depends largely on the progress you gentlemen make in design of engines and hull. It is a question on which any shipowner must be largely guided by the advice you give. The more rapid and successful the progress of your investigations the sooner the ship becomes obsolete. Progress in engine design can, of course, be met by re-engining a ship if advantage is not going to be taken of additional speed; but any composite design of more efficient propulsion means a new ship, and at the present time it looks as if ships should be built as simply as possible, and consequently as cheaply as possible, in order that the owner may be prepared to meet a big scrapping programme at an early date to take advantage of progress as it becomes proven.

It is interesting to compare running costs and building costs. Our running costs on the latest type of ship work out at no more than 10 per cent. above the pre-war rate, and other costs such as port, canal and light dues, stevedoring, towage, pilotage, &c., work out at about 75 per cent. in our trades, while building costs are about 80 per cent. above pre-war level. The chief reason for this is that the building cost is generally incurred wholly in this country, whilst in running costs, apart from the reductions due to more efficient design, we are considerably helped by the fact that a great deal of the expense of running is incurred outside this country, and is not therefore penalised by indirect rates and taxes.

At the moment we are in a slack period which generally synchronises with development in design and administration, and I am hopeful that if you can offer new designs and lower construction costs you will soon find that the British cargo shipping industry is willing to go forward with new construction.

International Electrotechnical Commission.

A SUMMARISED report of the recent meetings of the International Electrotechnical Commission in Sweden has been issued by the British Engineering Standards Association. From it the following notes have been abstracted.

It was generally conceded that the technical results were satisfactory and that the whole proceedings were a model of organisation. The meetings were held in the Houses of Parliament at Stockholm, and about 300 delegates, representing some twenty-five countries, were present. Professor Enstrom, of Sweden, was elected President in succession to Professor Feldmann, the retiring President.

Nomenclature.—The following names for the magnetic C.G.S. units are included in the recommendations put forward by Committee No. 1 for adoption:—Magnetic flux, maxwell; flux density, gauss; magnetic field intensity, oersted; magneto-motive force, gilbert. The term "Promaxwell" was agreed as the name for the practical unit.

Rating of Electrical Machinery.—General agreement was reached in regard to the outstanding items in connection with the rating of electrical machinery, and the I.E.C. will publish its rules as soon as possible.

Symbols.—The Advisory Committee No. 3 has at present in hand the second edition of Publication No. 35, the publication of graphical symbols for weak current installations (telephone, telegraph and radio communications), the consideration of graphical symbols for electric traction, relays and automatic devices employed in electric installations, and the introduction of other letter symbols in Publication No. 27. Considerable progress was made, and the second edition of Publication 35 was agreed to. The list of symbols for telegraphy will be completed in collaboration with the Comité Consultatif International pour la Telegraphie (C.C.I.T.).

Steam Turbines.—The Advisory Committee completed and the plenary meeting approved for publication Part I., Specification for Condensing Steam Turbines; and Part II., Rules for Acceptance Tests of Condensing Steam Turbines. These documents are the result of more than four years' labour, commencing prior to the New York meeting in 1926.

Lamp Caps and Sockets.—The recommendations covering most of the essential dimensions of the bayonet cap and the medium, flashlight and Goliath Edison screw caps were adopted. With regard to the few outstanding questions, it was decided to recommend that the International Commission on Illumination should be invited to call a meeting during its own plenary sessions which would be held in September of next year, and in the event of such a committee reaching agreement and placing its recommendations before the plenary meeting of the I.C.I., they could be published by the I.E.C. with a note explaining the position. The document would then, in due course, come formally before the next plenary meeting of the I.E.C.

The Committee recommended that, in view of the rapid development of safety fittings, these should be studied and proposals made in consultation with the fittings manufacturers for the shape and clearance dimensions for fittings in connection with each size of the screw caps.

Aluminium.—As agreement on hard-drawn aluminium could not be reached between American and European practice, it was agreed to postpone the adoption of an international standard and to record only that the proposals before the meeting would be acceptable to the European countries, the hope being expressed that in the near future it might be possible to bring the American and European viewpoints closer together so that the I.E.C. might be in a position to issue an internationally agreed standard at a later date.

Some progress was made in connection with annealed aluminium, and it was agreed that the definition of annealed aluminium should be modified as follows:—"The term annealed aluminium applies to aluminium with a tensile strength of not more than 9 kilos. per square millimetre and an elongation measured on a length of 100 mm. of at least 20 per cent. The aluminium under consideration is in the form of wires."

High-voltage Insulators.—It was agreed to recommend as standard for traction purposes for continuous current the voltages of 600 volts and 750 volts. It was decided not to accept the proposal to add 132 kV to the list of standard voltages. On the other hand, in view of the necessities of international inter-connection between large European networks, the Committee decided, but only provisionally, to complete the list of voltages by 400 kV.

The Committee then recommended the National Committees to submit for decision under the six months' rule the proposal to establish, unless otherwise specified, two tappings plus and minus 4 per cent. for distribution transformers with primary voltage less than 60 kV.

Considerable progress was made with the question of test for insulations.

Measuring Instruments.—At the meeting of the Advisory Committee held in Berlin in November last it was agreed to deal with two classes of integrating meters, and considerable progress was made towards drawing up the details of those intended for the smaller consumers based on the proposals of the German Committee. It was further decided that the class dealing with meters for the larger or more important consumers should be based upon the recommendations of the British Committee.

It was further decided to standardise two classes of instrument transformers, and considerable progress was made towards drawing up detailed requirements.

The plenary meeting ratified specifications for two classes of alternating-current watt-hour meters and two classes of current and voltage transformers more especially intended for use with watt-hour meters.

Rating of Rivers.—The following proposals were adopted:

1.—That the kilowatt be adopted as the unit of power.

2.—That either the foot or the metre be adopted as the unit of head.

3.—That the full power of the water and the gross head be used in the computations, showing in kilowatts the full theoretical power at 100 per cent. efficiency.

4.—That the ratings be based on three rates of flow:—

(*a*) Low rating on ordinary minimum flow, defined as the natural or present flow available 95 per cent. of the time, or approximate equivalent, with a statement as to the month of occurrence of the low flow;

(*b*) Middle rating based on median flow, defined as natural or present flow available 50 per cent. of the time, or approximate equivalent;

(*c*) Average rating on arithmetical mean flow; but

(*d*) That it shall further be permissible to any country desiring it to report in addition ratings of Q 75 and Q 25 on the duration curve.

5.—That the rating of storage be based on the water capacity and the gross head, and be expressed in terms of theoretical kilowatt-hours of energy in the water stored.

6.—That the rating of a developed site state the installed *turbine* capacity of the power plant expressed in kilowatts, and, in addition, that the rating of the site be made in the same manner as for an undeveloped site.

Oil and Switches and Circuit Breakers.—Agreement was reached in regard to definitions for the following terms and expressions:—

1.—*Operating Duty.*—The operating duty of an oil circuit breaker shall consist of the performance of one or more specified series of operations at specified values of current, voltage, power factor and frequency.

2.—*Series of Operations.*—A series of operations shall consist of a specified number of opening or closing operations in the specified order and at specified intervals.

3.—*Standard Series of Interrupting Operations, Especially for Factory Tests,* shall consist of opening and closing operations in accordance with the following formula:—0−3−CO−3−CO, where 0 is the act of opening, C is the act of closing, and 3 an interval of three minutes. The opening shall follow the closing immediately without purposely delayed action.

4.—*Standard Series of Circuit-making Tests* (for use when necessary) shall be C−*t*−C, where C is the act of closing and *t* an interval of three minutes minimum. (The circuit may be broken a short interval after C on a separate circuit breaker as specified in a test clause to follow later.)

5.—*Voltage.*—The voltage for determining the performance of the circuit breaker shall be the recovery voltage immediately after the interruption of all phases. The method of defining and selecting the recovery voltage will be discussed later.

6.—*Breaking Current for Determining the Performance of the Circuit Breaker* shall be the R.M.S. value of the alternating component of current through each pole of the circuit breaker during interruption at the moment of separation of the circuit breaker contacts.

The direct-current component of the breaking current shall not be higher than 30 per cent. of the R.M.S. value of the alternating-current component.

The above does not provide for circuit breakers for use under conditions in which there is a larger direct-current component.

7.—*Making Current.*—The making current for determining the performance of the circuit breaker shall be the maximum peak value of the current, including the direct-current component, through the circuit breaker at the moment of closing the circuit.

8.—*Short-time Current.*—The short-time current is the highest R.M.S. current that should be passed through the circuit breaker in fully closed position for five seconds.

9.—*Power Factor.*—(*a*) Every oil switch should be capable of giving satisfactory operation at any power factor.

(*b*) Tests should be made at a power factor not exceeding 0·15.

(*c*) The power factor should be determined from an oscillograph record.

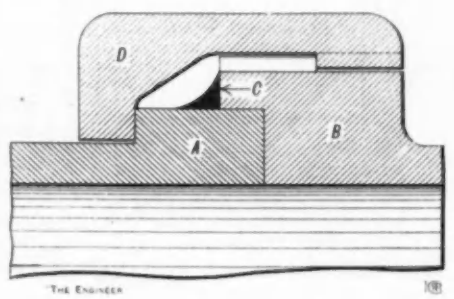
10.—*Breaking Power and Breaking Capacity.*—The Committee recommends that the rating of circuit breakers should not be given in terms of kVA.

The results of the work of the other Advisory Committees were not sufficiently definite for adoption, and cannot readily be summarised. They will be issued in full in due course.

High-pressure Steam Pipe Joint.

A CONTRACT for the supply, delivery and complete erection of the high-pressure steam and feed piping for the Liverpool Corporation new super-power station at Clarence Dock, has been placed with John Spencer, Ltd., of Wednesbury. This pipework will eventually have to withstand a working pressure of 450 lb. per square inch, superheated to 825 deg. Fah., and is to be fitted with the "Spencer" patented joint.

In this joint, designed and patented by Sir T. Harris Spencer, flanges, bolts, nuts and joint rings are entirely eliminated. The construction is shown by the sketch.



STEAM PIPE JOINT

The collars A and B are secured to their relative pipe ends by screwing, with sealing welds at the ends of the pipes. For the purpose of erection the pipe ends are drawn together in dead contact by means of a clamping device, and the weld C is made on site. This weld is to prevent steam leakage only, the loose collar D taking all the stresses due to expansion and contraction of the pipe range when under pressure.

Collar D, when in position, bears on the vertical face of collar A and engages upon the outside diameter of collar B. A series of small projections on the outside of the collar B engage with similar projections on the inside of the loose collar D, the pulling or closing action being obtained by means of a machined helix. Hence no tension can fall upon the sealing weld C.

AWARDS AT UNIVERSITY COLLEGE, LONDON.

THE following awards have been made at University College, London, in the Faculty of Engineering:—

Goldsmid Entrance Scholarship.—P. E. L. Fellowes, Ampleforth College, Yorks.

L. F. Vernon-Harcourt Prize (*Civil and Municipal Engineering*).—J. W. Hooper.

Chadwick Medal and Prize (*Municipal Engineering and Municipal Hygiene*).—S. Y. Ali-Khan (subject to confirmation by the Chadwick Trustees).

Archibald P. Head Medal and Prize (*for the Most Distinguished Engineering Student*).—F. E. Bland.

Civil and Municipal Engineering (*Third Year*) *Prizes.*—F. E. Bland and G. A. Judson.

All Subjects (*Second Year*) *Prizes.*—R. Russell, C. H. Cousins and N. E. G. Hill.

All Subjects (*First Year*) *Prize.*—R. M. A. Berenger.

Heating and Ventilating Prize.—F. E. Kerswill.

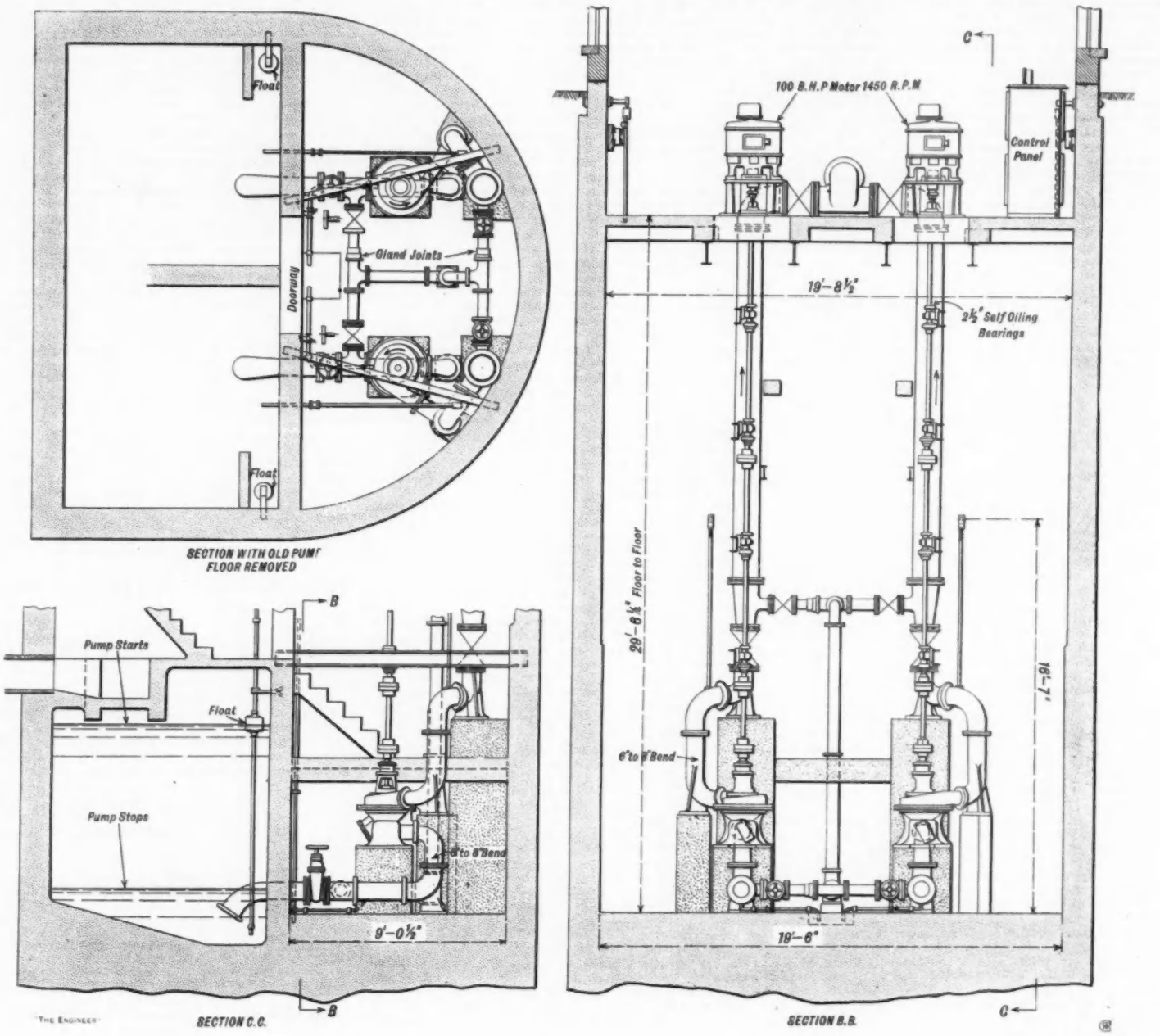
Diplomas have been awarded to the following:—

Civil and Municipal Engineering.—S. Y. Ali-Khan (with distinction), P. L. Chadha, E. Claxton (with distinction), F. H. Guneseker, J. W. Hooper (with distinction), J. B. B. Newton, K. Ray, F. G. Ruff and P. N. Singh.

Mechanical Engineering.—W. J. Baker, P. J. T. Evans, A. M. Hepworth and F. Praytuski.

Electrical Engineering.—A. M. Abrahamson, F. E. Bland (with distinction), J. Jackson, G. T. Jones, G. A. Judson (with distinction), J. H. Lucas, S. W. Peiris, D. R. Saben, S. Tungamani and E. Watson.

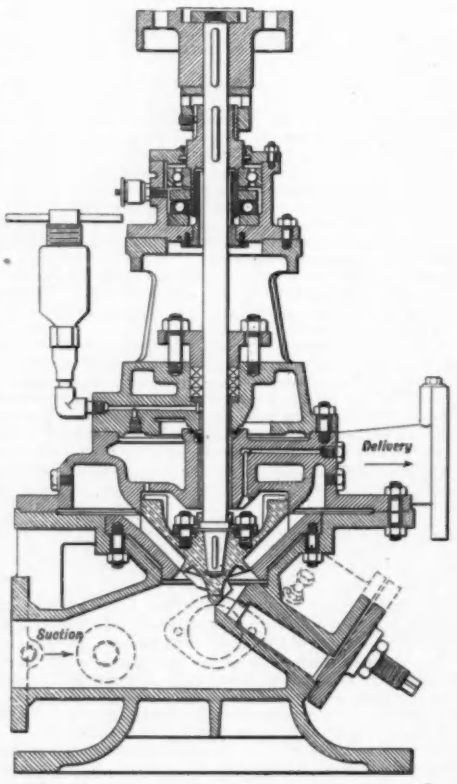
SEWAGE PUMPING EQUIPMENT AT KNOCKE-SUR-MER



Sewage Pumps at Knocke-sur-Mer.

THE popular little summer resort of Knocke-sur-Mer on the Belgian coast is well known to English visitors. Its growth since the war, including the newly developed village of Le Zoute, has been very great, and, as in all such cases, the question of effective sewage disposal became important. The necessity of preserving the amenities of the neighbourhood ruled out the possibility of putting the sewage into the sea. The only alternative was to deal with it at a sufficiently distant sewage plant, and Nature gave no facilities for getting it there, the country behind being flat and featureless. Recourse therefore to pumping was inevitable, and the scheme finally adopted involved the gravity flow of the sewage to a number of deep sumps, whence it was raised by pumps and delivered into the mains leading to the sewage farm. The main pumping station, when first put down, was equipped with two pumps of continental manufacture. These pumps, however, gave continual trouble through becoming choked with the solid and fibrous matter which is invariably present in raw sewage. To have attempted to protect the pumps by screens would only have changed the location of the trouble, even had the provision of screens been practicable. It would also have raised the question of the disposal of the matter arrested by the screens, which would have been a problem in itself. Something, however, evidently had to be done, for the choking of the pumps was so serious that to maintain anything like a continuous service it was necessary to have relays of men in constant attendance upon them.

The only solution was to replace the pumps by others which could deal with any foreign matter that might be present in the sewage. The type of pump selected by Monsieur Emile Cauterman, the Engineer in Chief and Director of Technical Services of the Provinces of Western Flanders, was the "Stereophagus," or "eater of solids," devised specially for such work a good many years ago by the late Hon. R. C. Parsons. The contract for the re-equipment of the pumping station was therefore placed by him with the Pulsometer Engineering Company, Ltd., of Reading, the manufacturers of the pumps in question. The principle of the Stereophagus pump is too well known to need detailed description. It comprises a single-sided impeller of conical form, the blades of which run almost



SECTION OF STEREOPHAGUS PUMP

in contact with the edge of an adjustable heavy knife. This knife is so set that its edge is traversed from one end to the other by the edge of each blade of the impeller as the latter rotates. As a consequence, all matter which would tend to clog the pump is continually sheared up by the action of the knife and the impeller blades, and is delivered in harmless lengths along with the liquid passing through the pump.

The design of a vertical Stereophagus pump, similar to those employed at Knocke, is illustrated herewith. The conical impeller, bolted and keyed to the end of the spindle, runs in a renewable liner fixed in the suction casting of the pump. The knife, of which mention has been made, can be adjusted in relation to the impeller by the square-ended screw shown opposite to the suction flange in the drawing. The upper end of the spindle runs in a ball bearing, and the weight of the spindle is carried by a ball thrust ring in the same housing. A grease-retaining sleeve prevents the lubrication of the balls from running down the spindle. Immediately beneath the coupling is a nut engaging with a thread on the sleeve, which transmits the weight to the ball thrust. By the adjustment of this nut, the impeller can be lowered so as to bring its blades as nearly as desired into contact with the renewable liner, thus enabling any wear of the impeller to be taken up without disturbing any part of the pump or shafting. All details are indeed so arranged that very long periods of service can elapse without any necessity for the pump being dismantled, or the suction and outlet connections interfered with. As a further convenience, a good-sized hand-hole gives access to the end of the impeller and the edge of the knife.

The installation at the main sewage pumping station at Knocke comprises two pumps of the vertical type, their arrangement being shown above. Each pump has a discharge branch of 152 mm. diameter, and is capable of delivering 75 litres per second, or about 1000 gallons per minute, against a total head, including friction, of 148ft. The pumps are placed at the bottom of a shaft, about 29ft. 6in. deep, and draw the sewage from a chamber at the side. Each pump is driven by a vertical three-phase slip-ring motor of the protected type, running at 1450 revolutions per minute on a 220-volt, 50-cycle circuit. The motors are situated at the top of the shaft and connected to the pumps by means of 2·5in. shafting running in self-oiling bearings. Each motor is rated at a normal power of 80 B.H.P., which is ample for the requirements of a

pump, even when dealing with solid matter. The action of the pumps is entirely automatic. On the upper floor level is a double unit control board, the switches of which are operated by floats in the sewage chamber. When either side of the chamber is full, the corresponding pump starts up by itself, and continues to run until it is stopped by the descent of the float to its lowermost working level. The pumps are situated well below the upper level of the sewage in the chambers, so that they are always primed before the automatic starting gear comes into action.

Owing to the growth of the district, the commune has built two subsidiary sewage pumping stations, and equipped them also with Stereophagus pumps, arranged to start and stop automatically, according to the level of the sewage in the adjacent chambers. The first of these stations has now been in operation for about eighteen months. It contains two pumps with 100 mm. discharge branches, each capable of delivering 25 litres per second, or 330 gallons per minute, against a total head of 114ft. Under such conditions the pumps absorb less than 34 B.H.P. each. The motors driving them run at 1450 r.p.m., and each is able to develop 45 B.H.P. if required. The second subsidiary sewage pumping station at Knocke contains two pumps, each delivering 10 litres per second (132 gallons per minute) at 1450 r.p.m., when working against a total head of 67ft. Less than 12 B.H.P. per pump is normally required, though up to 20 B.H.P. can be exerted by the motor, if necessary.

The three installations have, we understand, worked with no difficulty of any sort since they were first started up, and all the old troubles of pump chokeage have been eliminated. Indeed, so satisfactorily do the new pumps and the automatic arrangements work, that we believe the whole of the attention required at all three of the stations can be easily given by one man. The entire equipment of each station was supplied and erected by the Pulsometer Engineering Company, Ltd., of London and Reading, the work being carried out without a hitch from beginning to end under the superintendence of Monsieur Emile Cauterman.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Trade Situation.

THERE is little, if any, improvement in the heavy engineering industries of the Midlands and Staffordshire, and demand for iron and steel during the week has consequently been poor. What orders have been received have been of small dimensions, despite the fact that stocks in consumers' hands are very small. Producers have little confidence in any improvement of note in the near future, and are now turning their attention to the autumn, when they hope for a real revival of trade. The third quarter of the year is normally a quiet one, but this year it is likely to prove extremely flat and disappointing, for it is next to impossible to see where any new buying impulse is to come from. Speaking generally, the position in this district is much as it was a week ago.

Pig Iron.

Last week's quarterly meeting of the Midland iron trade furnished one surprise, for the reduction in pig iron prices was quite unexpected. It had become known that some continental foundry iron had been purchased for use in this district, and it is just possible that smelters considered they had held on to prices long enough, and that they would probably be the losers unless they granted some concession. Consumers say the half-crown per ton conceded is quite insufficient. It should have been at least double that amount, they assert, if it was to be any assistance to them. It is insufficient, they say, to influence the course of business, and they are continuing to keep a close watch on the Continent, where price deflation may further lower the market. At the moment, with the reduction made by Midland furnacemen, there is no advantage to be gained by purchasing foreign iron. The foundry iron bought from the Continent last week is reported to have cost just about what Derbyshire foundry is now quoted. Buying has not been stimulated, and this week purchases have been on similar lines to recent weeks —just enough to meet immediate requirements. Though stocks of iron at the furnaces are increasing—to what extent is not known—it has not so far been necessary to curtail operations in Northamptonshire and Derbyshire, though furnaces have gone out of commission in other ironmaking districts. The new selling prices of Midland brands of iron are :—Northamptonshire forge, £3 8s. 6d.; No. 1 foundry, £3 15s. 6d.; No. 2, £3 14s. 6d.; No. 3, £3 12s. 6d.; No. 4, £3 11s. 6d.; Derbyshire forge, £3 12s.; No. 1 foundry, £3 19s.; No. 2, £3 18s.; No. 3, £3 16s.; No. 4, £3 15s., delivered at stations in the Black Country. Puddling furnaces will get their supplies at £3 17s. 6d. from Northamptonshire and £3 11s. from Derbyshire.

Steel.

In the finished steel trade conditions are unchanged. Demand has shrunk in nearly every department, and makers are unable to see far ahead. Structural engineers have a certain amount of reconstruction work on hand, but the tonnages of steel required are not very large. Heavy engineers are not active, and while light engineers are better off, the outlook is not considered to be good. Consumers of steel are unwilling to consider anything but hand-to-mouth buying. Stocks are not large, but are easily and quickly replaced. Roll changing at the mills is very frequent, and profits are accordingly reduced. Values are maintained at the basis fixed by the Association. In those departments where producers are free to quote their own prices, values are tending downwards. For instance, small steel bars are now obtainable at £7 18s. 6d. upwards against £8 recently considered the minimum. Billets have receded to £5 18s. 6d. upwards, against £6 upwards. Welding tube strip has been reduced by South Staffordshire manufcturers from £8 15s. to £8 5s. Prices for other classes of strip are variable. Sheet bars command £5 15s. to £5 17s. 6d. Continental competition is no less keen, and the situation as to foreign prices gives cause for concern. The Cartel basis prices are being undercut, and offers of material at reduced rates are reaching consumers in this district. The position is being closely watched, reports to hand as to what actually is happening being very conflicting.

Staffordshire Bar Iron.

In the Staffordshire iron trade there is no change to record. Last week's quarterly meeting failed to add materially to the orders standing on ironmasters' books. No great accession of business was looked for, so ironmasters were not disappointed. The orders coming in are not equal to those being executed, and manufacturers find it difficult to keep works open. Conditions, as previously reported, vary very much, according to the grades of iron, and while trade generally is poor, mills engaged in the production of best bars are relatively active and able to maintain a regular output. Values are unchanged in all departments, marked bars being £12 10s., Crown bars £10 to £10 7s. 6d., nut and bolt and fencing bars £9 and iron tube strip £11 2s. 6d. Strip mills are not doing quite so well as latterly, but there is sufficient business passing to enable makers to keep up their selling price.

Galvanised Sheets.

The improved demand for galvanised sheets is maintained, though orders are irregularly received. Most local mills have bettered their position, and are not now offering delivery quite so quickly as they were a month or two ago. Values have not gained much strength, but there is a tendency to ask a little more than basis rates. The figure ruling for 24 gauge corrugated sheets this week was £11 17s. 6d. Manufacturers of sheets have at date the advantage of cheap spelter, which is now selling at an almost unprecedented level, and this to some extent makes amends for the lower range of sheet prices when compared with values a year ago. There is little interest just now in tin-plate in this district, and the selling figure remains on the basis of 18s.

Production Figures.

Midland industrialists were quite prepared for the poor showing made by the iron and steel trades, as shown by the statistics of output for the month of June. They failed to see how anything but retrograde figures were to be obtained, especially when it became known that blast-furnaces were being blown out. It is noted that the number of furnaces in blast at the end of June was 133, a net decrease of eight since the beginning of the month, nine furnaces having been blown out and one having commenced operations. Taking this into consideration, the production of 356,200 tons is considered very creditable. A large proportion of the furnaces taken out of commission were producing basic pig and hematite. Comparatively little change has been made in Midland furnaces producing ordinary forge and foundry grades. The previous month the output amounted to 614,500 tons. Of the production, 122,300 tons were foundry iron, 21,900 tons forge, 227,900 basic, and 171,700 tons hematite. The June output of steel ingots and castings amounted to 600,100 tons, compared with 691,900 tons in May, and 830,900 tons in June, 1929. Part of the decline in the case of steel is, of course, accountable for by the Whitsuntide holidays.

Works Extensions.

In encouraging contrast with reports of trade depression, it is pleasant to note that a Wolverhampton firm, Efandem Company, Ltd., Fallings Park, manufacturers of electrical apparatus, has submitted for the approval of the Town Council plans for considerable extensions to its factory. The firm, which at present employs 1200 hands, is going in for very large extensions on the battery side. Given a fair field, the firm says, it does not fear the keen competition of German and American manufacturers.

Overseas Trade.

Midland manufacturers were pleased to learn that last month's exports of vehicles, including locomotives, ships, and aircraft, showed an advance on the previous month of £2,284,726, and that the returns for the first half of the year compare favourably with those of the corresponding period of 1929, shipments being up by the value of £260,452. Iron and steel manufactures were down when compared with June last year by £681,053, and exports of non-ferrous metals and manufactures were less by £307,807. Imports of iron and steel were less than in June, the respective values being £1,783,837 and £2,083,522. For the year to date imports amount to 1,533,039 tons, valued at £12,564,651, compared with 1,339,805 tons and £11,965,670 in the preceding year.

Order for Switchgear.

Birmingham is to provide some of the switchgear required by the Central Electricity Board in connection with schemes being carried into effect in Central England, Mid-East England, and North-West England and North Wales. The successful firm, which has received a substantial order, is the General Electric Company, Ltd., of Birmingham.

Iron and Steel Trade Inquiry.

The Iron and Steel Trades Confederation, at a divisional conference of branch officers at Wolverhapmton, on Saturday last, passed the following resolution : "That this representative meeting of delegates of the Midland districts of the Iron and Steel Trades Confederation demand that the Government should publish the report of the inquiry into the iron and steel trade, in the same way as they published that relating to the cotton industry."

Electricity.

That the increased use of electricity in the Midlands is not confined to the Birmingham area is clearly shown by the statistics just issued by the West Midlands Joint Electricity Authority, which serves an area of approximately 10,000 square miles. During the past year, ended March, 230,973,921 units of electricity were generated, of which 16,722,664 were used on works, 8,119,559 were lost in transmission, and 206,131,698 were sold. The percentage of units sold to units generated was 89·24. At the end of the year the total capacity of plant was 101,600 kilowatts, and the maximum demand was 76,000 kilowatts. In the Birmingham area, as recently stated in this column, electric power is being much more generally used than formerly, and an increasing amount of units supplied by the West Midland Authority is for power purposes.

Industry and the Severn.

At the annual meeting of the Severn Development Association, it was stated that interest in the work of the association is spreading, and, as its connection with financial and industrial organisations in London and elsewhere is strengthened, there is hope that the example of Steatite and Porcelain Products, Ltd., which recently established a factory at Stourport, will be followed by other industries seeking fresh factory sites. The Association has received promises of support from the Electrical Development Association, the Associated Chambers of Commerce, and the Federation of British Industries. Provided financial support is maintained, it is hoped that effective advertising will be the means of attracting fresh industries to the area of the river Severn.

A Free Factory Site.

Any person or company prepared to start a factory in Droitwich can have a 3-acre site free of cost. Alderman C. H. Everton has offered a factory site adjoining the main Worcester–Birmingham road, the Great Western Railway, and the Worcester–Birmingham Canal, in an endeavour to find employment for some of the unemployed of the town. For some years Droitwich has been suffering from the removal of the salt trade to Stoke Works, and at present there is no industry, except the bathing industry, in the town. This is not sufficient to employ many people, and, in consequence, there is a large amount of unemployment in the borough. No restrictions, it is understood, will be imposed other than that the trade carried on at the site shall not be objectionable.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

A Fall of a Million.

TEXTILE machinery shipments last month reached a very low value compared both with the corresponding period of 1929 and 1928. The total exports in June amounted to 8007 tons, valued at £754,926—including 6542 tons of spinning and twisting machinery, valued at £604,991, and 1143 tons of weaving machinery, valued at £96,692—against 9160 tons and £858,726 a year ago and 12,281 tons and £1,135,501 in June, 1928. The Russian, French and Chinese markets make a better showing than they did a year ago, but in all other directions shipments have shown declines of varying extent. The takings of British India head the list at £170,647, followed by China with £105,573, Russia £84,797, France £73,666, Japan £40,536, the Netherlands £37,458, Germany £36,037, the United States £29,494, South America £17,278, and Australia £10,446, aggregate shipments to "other European countries" amounting to £117,108. The fall in the value of exports during the first six months of the year was over a million compared with last year and of nearly £1,200,000 compared with the first half of 1928, the quantity being 50,182 tons and the value £4,819,816.

From the Wirral to North Wales.

There has been a revival of interest during the past few days in the scheme for throwing a road across the River Dee from West Kirby, on the north-west of the Wirral Peninsula of Cheshire, to Point of Air, on the North Wales side. It is a year or two ago since the scheme was last in the limelight, and even now it is a long way from the realm of practical politics. The Ministry of Health, however, has latterly taken some notice of the project and a large-scale conference of authorities directly interested in it may shortly be held in Liverpool. Briefly, the scheme provides for the construction of an embankment, about 6 miles in length, carrying a roadway across the estuary, provision being made for a bridge to span the existing navigable channel of the Dee near the Welsh coast. Such a roadway would cut out the present 30 to 40-mile journey from the Wirral Peninsula to North Wales *viâ* Chester.

Profits and Raw Material Prices.

A fall in the profits of Ward and Goldstone, Ltd., electric cable and accessory manufacturers, Pendleton, Manchester, to £12,588 in the year ended March 31st last from £17,471 in the previous year is attributed by the directors, among other causes, to the progressive falls in the value of the commodities mainly used in the company's business, namely, copper and rubber. This has necessitated the writing down of stocks. The output and sales for the year have been well maintained, although it is pointed out that selling prices leave little margin over costs owing to the keen competition from the Continent, where wages and taxation are substantially below those ruling in this country. Interim dividends of 3½ per cent. on both the preference and ordinary share capital have already been paid and no further distribution for the past twelve months is proposed.

Ship Canal Traffic.

Exports from the Manchester Ship Canal during June included rolling stock for the Argentine, railway coaches being shipped on the s.s. "Beljeanne" for Buenos

Aires. Other exports of rolling stock included consignments of locomotives for India on the s.s. "Beldis."

Engineering Appointments.

Mr. A. L. Lunn, who, since 1927, has been deputy chief engineer of the Manchester Corporation Electricity Department, has accepted an appointment with the London Underground and will take up his new duties in September. Mr. Lunn is chairman-elect of the North-Western Centre of the Institution of Electrical Engineers. With a break of about five years from 1910 to 1915, when he was with the Sunderland Corporation, Mr. Lunn has been associated with Manchester Corporation since 1906. Mr. Henry Nurse, at present deputy borough surveyor of Leigh, has been appointed to the post of engineer and surveyor to the Irlam Urban District Council, in succession to Mr. W. C. Codling, who has been appointed deputy engineer and surveyor of Bolton.

Non-ferrous Metals.

There has been nothing startling in the way of developments on the non-ferrous metals market this week, although further slight weakness on balance has to be recorded in respect of copper and tin, due, in both instances, to weakness in the statistical position, coupled with ineffective control of supplies. At the moment of writing, however, the situation is somewhat better than it was at the close of last week, a slight recovery from the worst having been made during the early days of this week. Copper is meeting with only a limited demand, and there has been a loss on standard metal of from 2s. 6d. to 5s. per ton, very little difference at present existing between spot and forward quotations. Inquiry for tin for industrial purposes is far from good and bearish influences have resulted in a net fall in values of nearly £3 on the week. There has been no big weight of buying going on in the case of lead, but supplies in this section are not excessive and the price levels which have been ruling during the past month or so have been maintained on balance. A slight halt in the downward trend of values on the spelter market has been experienced, but the position in respect of this metal continues uncertain and buyers are operating cautiously.

Iron and Steel.

Lancashire foundries have not responded to last week-end's reduction of 2s. 6d. in Midland irons by ordering any more freely, and sellers are not disposed now to look for any material improvement in the situation until later in the year. The new rates for delivery in the Manchester area are 74s. 6d. per ton for Derbyshire and Staffordshire brands of No. 3 pig iron, with forge quality quoted at 69s. 6d. to 70s. 6d. Scotch iron at from 93s. to 94s., and West Coast hematite at about 89s. per ton, all delivered equal to Manchester. Bar iron is in quiet demand at £10 5s. per ton for Lancashire Crown quality, and £8 15s. for seconds. Additional orders recently secured by locomotive engineers in Lancashire hold out promise of sustained operations in this branch, but in most other respects, particularly in constructional work, there has been no indication of improving conditions. Meanwhile, quotations for domestic steel products show very little change since a week ago. The breakdown of the selling arrangements recently put into operation by the Continental Steel Cartel has resulted in appreciably lower prices being asked on this market for finished meterials, but users appear to be more interested in watching developments than in placing actual business.

BARROW-IN-FURNESS.

Hematite.

There is a complete absence of any sign of improvement in the hematite pig iron market, and it would not be surprising to hear of further furnaces being put out of action. The lack of life in the steel trade and the consequent dwindling in the demand for local steel requirements will also have its effect on local iron production. The majority of customers are taking just sufficient pig iron to meet their immediate needs, and there is little inclination to place orders for forward delivery. Most of the orders for forward delivery which existed a few months ago are practically exhausted. There is a certain amount of business with the Continent, but the tonnage is not great. American business might improve in view of the iron available. The iron ore trade naturally reflects the state of things in the pig iron market, and the outlook is not bright either from the point of view of local demand and outside requirements. The steel trade is very quiet and neither Workington nor Barrow are well situated as regards orders for railway material; in fact, there is some fear of one or both closing down for a period. Shipping is still quiet. Engineering is moderate and shipbuilding fair.

SHEFFIELD.

(From our own Correspondent.)

No Change in Steel Conditions.

IT is still impossible to report that the different branches of the Sheffield and district steel trade show any expansion. The demand for the city's products has fallen to a very low level, compared with capacity, and there is nothing in the outlook to indicate any change in the present situation. There are still hopes of a revival, of course, but at the moment things in most departments are described as being "about as flat as they can be." The total number of unemployed persons on the books of the Sheffield Exchange now reaches 37,937. Bulk steel is one of the quietest sections. Although the United Steel Companies have an additional furnace working on basic steel at Templeborough, the majority of the open-hearth furnaces in the district are still idle. The scrap merchants report that little, if any, more melting material is going into the works, and they, like the steel makers, are unable to hold out any hopes of an early revival. Although stocks must be low, consumers of both steel and raw materials are only buying sufficient for immediate requirements, and there is a painful absence of bulk inquiries. What I have said in recent weeks about the condition of the special branches of the steel trade—automobile supplies, stainless, heat-resisting and non-corrodible steels and cold-wrought steel and strip—remains true. These branches are better fixed than those which deal with ordinary commercial steel, and are doing a considerable trade, but the volume is below what it was a few months ago. A policy of strict economy is in operation all round, and there has been a good deal of drastic reduction in departmental costs. The competition for work is so severe that prices are reduced to the lowest minimum; but even then foreign quotations cannot always be equalled. It is some consolation, however, to know that the quality of the Sheffield product often decides the matter in favour of the local manufacturer.

Refractory Progress.

The University of Sheffield has long rendered excellent service to the trades of the city, and continues to increase its facilities for so doing. Among its departments is one of refractory materials, which is the only one at an English university devoted wholly to work on these materials, and it has just been improved by the opening of new research laboratories. The department has actually been in operation since 1917, and, although its work has been hampered by lack of accommodation, it has been so successful that a speaker last week expressed the opinion that it had saved the industry a quarter of a million a year. The need for research in refractories has been emphasised in recent years by developments in steel-making processes. Professor C. H. Desch, the Dean of the Faculty of Metallurgy at the University, pointed out, on the occasion of the opening of the laboratories, that high-frequency induction furnaces were beginning to play an important part in the manufacture of steel. They soon found, he said, that it was possible, in such furnaces, not only to melt the steel, but to melt the most refractory crucible. As metallurgical processes developed, they would be called upon to find materials capable of withstanding much higher temperatures than at present—super-refractories. It was only possible to get them in a well-equipped research laboratory.

Collection of Colliery Dust.

An interesting development has just been carried out at Hickleton Main Colliery, one of the best equipped in South Yorkshire, in the form of the installation of plant for the collection of dust on the screens. Dust which was formerly in the atmosphere is being collected to the amount of 50 cwt. per day, and so satisfactory has been the working of the plant during its three weeks of operation that arrangements are being made to extend it to several points not in the original scheme. It is hoped eventually to collect 3 tons of dust per day. The plant operates on five tipplers and screens, four of which deal with coal from the Barnsley seam, and one with coal from the Parkgate seam. The points of collection are one on each tippler, four on each jigging screen, one on each slack discharge shoot from the screens, and three other points on slack belts. Davidson and Co., Ltd., of Belfast, are responsible for the design of the plant, and the fan and cyclone collectors are of their manufacture. The whole of the pipe work included in the plant has been carried out by Simpkin and Co., of Sheffield. The fan is designed to circulate 30,000 cubic feet of air per minute at a pressure of 6in. of water, and the power taken is about 60 horse. The dust-laden air is first passed through the cyclone collectors, which Messrs. Davidson state have an efficiency of 95 per cent., and only comparatively clean air passes through the fan. Thus, any abrasive action inside the fan is eliminated. The cost of the plant, including all pipe work, fan, collectors and structure, but not including motor and switchgear, was approximately £2000.

Trade with America.

The value of steel exported from Sheffield to the United States during the quarter ended June 30th was £30,000, showing an increase of £2000 on the preceding quarter. The return of cutlery exports to the same market was much less satisfactory. In this case the value was only £7175, as compared with £35,550. The largest declines were in safety razor blades and blanks, which have for several years consituted the bulk of the exports under the head of cutlery. The value of the blades fell from £15,000 to £410, and of the blanks from £15,000 to £4000. The leading American firm of razor makers is still using Sheffield made blanks and finishing them in its own factory. Blade exports are subject to fluctuations. The quarter's exports of pocket-knives, ordinary razors and edge tools all showed small declines. Turning from North America to South America, it is interesting to note that an excellent order for scissors has just been received from that Continent. At the celebration of the 150th birthday of the firm of Champion and Co., scissors manufacturers, Broadlane, Sheffield, last Saturday, the proprietor announced that on the previous day he received an order from South America for 2500 pairs of the firm's special folding scissors. This was the largest order the firm had received for one pattern during the last ten years, and it was gratifying to know that in fulfilling it they were re-opening old ground. One hopes that this evidence of South American appreciation of Sheffield goods may be an augury for the success of the important mission to the Continent which is shortly to be carried out, with the Master Cutler at its head. One of the principal objects of that mission is to demonstrate the ability of Sheffield to supply, on competitive terms, a greater share of South American requirements in tools and cutlery.

A Railway Tunnel Clearance.

Two railway tunnels on the L.N.E.R. at Hattersley, near Glossop, which have been in existence about a hundred years, have just been demolished, as they were too low for present-day rolling stock. In order to get rid of them it has been necessary to remove a large hill, and the work has been in progress two years, during which time the railway service has not been interfered with. Steam navvies, each taking 50 cwt. of soil at a time, have been employed, and upwards of 2000 tons of material a day have been removed. The final clearance of the tunnels—which were respectively 340 yards and 100 yards long—was effected with dynamite.

Municipal Schemes.

The sale of the Queen's Dock at Hull by the L.N.E.R. to the Corporation for £117,000 having been sanctioned by a Committee of the House of Lords, the Corporation Committee concerned is taking steps to follow the matter up. The filling up of the dock will involve the removal of Whitefriargate Bridge, and the city engineer has been requested to prepare plans and estimates for a temporary bridge 50ft. wide over the dock leading from Cross-street to Alfred Gelder-street. The erection of this bridge will be followed by the formation of a new street from the City Square to Alfred Gelder-street. At Horncastle, the Urban Council is going in for a scheme of gas works reconstruction, the present plant having been condemned by Mr. J. J. Simpson, gas engineer, of Scunthorpe, who was recently called in to report upon it. An additional Tully generator, of a daily capacity of 100,000 cubic feet, is to be installed first, at a cost of £1600, and this is to be followed by new purifiers, an additional exhauster and a new holder, in addition to which considerable lengths of new mains are to be laid. The total cost of the works is estimated at £8000. The Chesterfield Urban Council has approved schemes, prepared by its engineer—Mr. H. Taylor—for works of sewerage and sewage disposal at North Wingfield and Pilsley at a cost of £10,776, and at New Tupton at a cost of £6480.

NORTH OF ENGLAND.

(From our own Correspondent.)

Another Ironworks to Close.

OF the series of industrial disasters in the North of England brought in the trail of the depression during the past few months, probably the most profoundly disturbing is that in connection with the Port Clarence Iron and Steel Works of Dorman, Long and Co., Ltd., Middlesbrough, which are to be closed down shortly. With the exception of some few stoppages through minor trade disputes, these works have been in constant operation since 1854. The coke oven and by-product plants will continue at work, but some 2000 men will be added to the list of unemployed. Sherburn House Colliery, County Durham, where about 1000 men are employed, and from which the Port Clarence Works drew considerable supplies of coal, will, in consequence of the stoppage of the works, close down on July 28th. The blowing out of two blast-furnaces at the Ayresome Ironworks of Gjers, Mills and Co., Ltd., Middlesbrough, was completed during the past week-end. Thus another Teesside works is added to the lengthy list of closures and a big complement of men to the unemployed register. Bad trade and unprofitable prices are advanced as reasons for Gjer, Mills' action. They have been unable to find a market for their output, and with accumulated stores on hand they had no other option than to cease production. During the past six months seven ironworks on the North-East Coast have been laid idle.

Coal Trade Depression.

From nearly all the coal-mining districts of Northumberland and Durham there are reports of the continued severity of the depression in trade. Every week-end more men are put on notice. A number of the smaller pits and older seams are being closed down, while at the larger collieries fewer hands are required, because of the curtailment of production. The putting out of operation of more steel plant, including several blast-furnaces, has given a further setback to furnace coke, the production of which will doubtless have to be considerably reduced. Thus the conditions all round are very disappointing. In Northumberland one colliery did not get a start at all in the past six days, and for none of the pits are the prospects any better for the next few weeks. Collieries are engaged principally in producing coal on old contracts, as little new business is obtainable. The difficulty with the old contracts is that merchants are not always able to take out their quantities, as their customers are so well supplied with fuel at the moment.

Cleveland Iron Trade.

Conditions in the Cleveland pig iron trade are still perturbing. Traders are resigned to a period of extreme slackness until after the holidays. This week the Glasgow Fair holidays begin, and curtailed deliveries to Scotland will further narrow the outlets for Cleveland iron. But in spite of all the difficulties, Cleveland ironmasters refuse to cut prices which remain unchanged. No. 1 foundry is 70s.; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; and No. 4 forge, 66s.

Hematite Pig Iron.

Reduction of make of East Coast hematite iron has greatly checked additions to stocks, which are heavy. Prospect of output being near level of current requirements has tempted makers to take a slightly firmer stand, though they are still being undersold by second hands, who hold moderately large parcels. Producers quote at the equivalent of ordinary qualities at 71s., which they declare is several shillings below cost.

Ironmaking Materials.

The foreign ore trade is stagnant, and 20s. is just a nominal sellers' price for best Rubio. Blast-furnace coke is difficult to dispose of, but makers refuse to entertain forward contracts on the unremunerative terms named for early delivery. Prompt parcels of good average quality can still be bought at 16s. 6d. delivered at the works.

Manufactured Iron and Steel.

Business in the various branches of the manufactured iron and steel trade develops very slowly, and

fear is entertained that more machinery may have to be laid idle shortly. Prices, however, are maintained.

The Coal Market.

The very substantial limitation of output for all descriptions of coal has failed to steady values, the explanation, of course, being the total absence of new business for any continental centre. All Scandinavian, North Sea, and Mediterranean port operators state that there are abundant stocks, and the continental inland consumptive demand is far below the normal volume. All classes of Northumberland or Durham steam coal are on offer for prompt or for August to September delivery at weakly held minimum prices. Fitters hold steadily against any concessions, and contractors are also holding for the minimum. Best Northumberland steams are at 13s. 6d., with seconds at 12s., and smalls 10s. There is no change to record in the Durham coal outlook. Best gas qualities are easy at 15s., and second gas at 12s. 9d. to 13s. Coking unscreened coals, while showing no improvement, are held at 12s. 9d. to 13s. 3d. The bunker trade is erratic. For the coaling stations requirements are meagre, and for vessels loading at the ports or those calling for supplies whilst *en route* for other destinations are in small number and fail to stimulate the market. Good ordinary descriptions are quoted at 12s. 6d. to 13s., and superiors at 13s. 6d. to 14s. Gas coke is quiet, but is held firmly owing to the limited production and the prospects of heavy autumn demands. Up to 21s. is asked for any position. Patent oven coke is moving off slowly for immediate delivery at 17s. Forward there is a good inquiry, but buyers confine themselves to sounding the market, and as makers' ask from 17s. 6d. to 18s., actual trading is at a standstill. Beehive and superior coke is quoted nominally at 24s. to 28s.

Ironstone Miners' Wages.

A 3 per cent. reduction in the wages of Cleveland ironstone miners during the next three months was the outcome of a conference this week between the mine-owners and miners' representatives. According to the usual formula for the fixing of wages, the owners were entitled to make an even larger reduction. The ascertained selling price of pig iron for the past quarter showed a decrease of 3s. 1·69d., as compared with that of the previous quarter, and in accordance with the sliding scale arrangement this should have involved a reduction of 3·9 per cent. As a result of the change, wages will drop to 59 per cent. above base rates.

SCOTLAND.

(From our own Correspondent.)

Fair Holidays.

THE annual Fair Holidays are being held this week and next week in the east and west of Scotland districts. So far as can be ascertained, business generally remained featureless up to the commencement of the holidays, there being an absence of pressure for the supply of steel, iron or coal for use over the vacation. The usual duration of the holiday season is about ten days, but in a number of instances the time will be at least fourteen days, owing to the lack of business.

Steel.

All branches of the steel trade require fresh business, plants in most instances being operated far below capacity. A steady rate of production is most difficult to maintain, makers as a rule having only sufficient specifications on hand to maintain an average of three days per week. Conditions may improve when materials for the new ships recently ordered are required, but the immediate outlook is none too promising, so far as plates and sections are concerned. Tubes are irregular. Heavy varieties are comparatively well specified, but smaller descriptions are so short of orders that several mills have been thrown idle. This applies particularly to butt welded tubes. The demand for sheets also is uneven. Light varieties hold their own, but heavy black and galvanised sorts are poorly specified, especially for export.

Iron.

The position at the bar iron works has not improved. The market is very bare of orders, even the usual seasonal demands from abroad having failed. Re-rolled bars at £12 7s. 6d. per ton, home or export, also experience a very thin time. Pig iron has not improved with the establishment of cheaper minimum prices, and in all likelihood the number of furnaces in blast will be reduced during the holidays.

Scrap.

The demand for scrap has dwindled away and prices are fluctuating, with heavy steel about 52s. 6d. and cast iron machinery 65s. per ton.

Coal.

The miners in the Lothians are on holiday this week and next week, and the collieries in the West of Scotland and Fifeshire will be idle. As a rule, supplies of round coal are sufficient to meet all demands over the stoppage, but washed nuts may be cleared. During the past week the lack of fresh business has been as severe as ever, and the market remained in a depressed condition right up to the holidays. Aggregate shipments amounted to 220,345 tons, against 244,986 tons in the preceding week and 294,884 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

So far as business for prompt loading is concerned, it cannot be said that there is any improvement in the steam coal trade of this district. Last week the returns of the Great Western Railway Company showed a total of just over 510,000 tons, which compared with 532,500 tons for the preceding week and with 597,232 tons for the corresponding period of last year. There were no less than forty-two idle tipping appliances at the various docks on Saturday last and only one steamer was waiting to berth, but this week started with the conditions much better from the loading point of view, as the total of idle appliances on Monday was reduced to twenty-one, and there were thirteen steamers waiting to get into berth, of which eight were at Swansea. At the same time it is feared that the current month will not be a good one, and it will be a relief if the returns of exports come up to the figures for June. According to the Customs statistics, exports from South Wales for June came to 1,670,369 tons, which was the lowest monthly return for this year and compared with the monthly average for 1929 of 2,024,326 tons. It is, of course, realised that at the moment the conditions are about as bad as they can be. Numerous collieries are working very short time, but unsatisfactory as trade is, it is surprising the optimism that prevails regarding the future. It is, of course, qualified optimism. There is very little on the surface to justify the optimistic spirit. Signs of improvement do not strike one in the eye, and it may be that it is due more to an instinctive feeling than otherwise, yet there is the feeling that provided extra costs are not placed on the industry by legislation, and that competition does not get keener than it is now, better times will be experienced in the autumn. But it is useless to be blind to the severity of foreign competition. Reference was made last week to the special railway rates introduced as from the beginning of this month by the German National Railways in order to assist the German coal industry by facilitating their export trade of surplus coals, and there is the fact that during the past six months Polish coal prices have been reduced from 17s. to 12s. f.o.b. Danzig and Gdynia, by reason of a 5s. per ton rebate in their railway rate from pit to port. It is really surprising to find what competitition there is for orders. For instance, who would imagine that Turkey was in the field, yet recently when there was an inquiry for about 50,000 tons of washed smalls for electrical works at Piræus to be delivered over a period, and prices for Welsh coals went in at round about 21s. c.i.f. Piræus, it was learned afterwards that Russian coals were offered at 18s. 9d. and Turkish coals at 15s. 6d. c.i.f. Piræus, and the order went for Turkish coals. Still, although there are not many inquiries at the moment on the market, the fact remains that the inquiry is broadening slightly, and shipowners, who are ever optimists, are seeking prices for bunker coals over the next few months, which shows that they have distinct hopes of putting more of their tonnage into commission in the near future. At present there is nothing practically in the freight market to justify this action, particularly when it has to be recorded that since last week another low record in outward freight rates since the war has been established, as, in addition to 5s. 10½d. being done for Genoa, the extraordinary rate of 7s. has been taken for a steamer for Alexandria.

Tipping and Weighing Charges.

A special meeting of the Cardiff Chamber of Commerce on Monday decided to strongly oppose the Great Western Railway Company's application to the Railway Rates Advisory Committee for authority to increase the charge for tipping and weighing coal at their South Wales docks, and for the stabilisation of other statutory dock charges. The G.W.R. Company gave notice on June 2nd last of its intention to ask the Raliway Rates Advisory Committee for power to increase the tipping and weighing charges from 6d. to 7½d., and also that other charges should be stabilised at 60 per cent. above the pre-war standard. The contention of traders is that charges should be decreased in view of the state of trade rather than that they should be raised. The G.W.R. Company's application comes up for hearing in London on Tuesday next.

Dowlais Works Stop.

The blast-furnaces and steel department of the Dowlais (Merthyr) Works closed down last Saturday, and 1500 men are idle. How long the stoppage will last, it is impossible to say, but this step has been taken as a temporary measure, and it is stated that a resumption will be made as soon as market conditions improve. In the meantime, a staff of 500 men is being retained in employment on work at the Big Mill Coke ovens and general maintenance. Unfortunately, it is not only the immediate area at Merthyr which suffers as the result of the interruption of work at the blast-furnaces and steel department. It extends to the docks at Cardiff, as doubtless there will be a curtailment of imports of iron ore. Compared with twelve months ago, these imports have fallen off considerably. At that time imports into South Wales were between 40,000 and 50,000 tons per week. There were then ten blast-furnaces in operation, but now this figure has been reduced to about two. During the past six weeks imports of iron ore have only averaged about 12,000 tons per week, compared with about 25,000 tons in May.

Employment Schemes.

The Swansea Borough Council met on Monday to consider the advisability of promoting a Bill in the next session of Parliament for the acquisition of gathering grounds and the construction of a big impounding reservoir to meet the increasing needs for water in the district. A definite decision was not then come to, but will be taken at a later meeting this week. When the question was first brought up it was indicated that the scheme would mean an expenditure of approximately £900,000. The Porthcawl Urban Council has decided to submit seven schemes for employment for next winter to the Ministry of Health, the total cost of these schemes being estimated at about £130,000.

Current Business.

The tone of the steam coal market remains quiet in all branches, except that for sized qualities which are scarce and relatively firm. Large coals are plentiful and smalls can be secured without a great deal of difficulty. Coke and patent fuel display no special feature, and pitwood continues round about 27s. 6d.

CATALOGUES.

BENNO SCHILDE MASCHINENBAU A.G., Hersfeld, Germany.—A book on apparatus for the chemical industry.

B.E.N. PATENTS, Ltd., 92, Tottenham Court-road, W. 1.—A leaflet giving particulars of the B.E.N. "Pneu-Spray" finishing plant.

VACUUM OIL COMPANY, Ltd., Caxton House, S.W. 1.—No. 21 of the Gargoyle Technical Series, "The Delvac Mechanical Lubricator."

ASHMORE, BENSON, PEASE AND CO., Ltd., Stockton-on-Tees.—Leaflets on Freyn-design chimney valves and continuous stock-line recorders.

JOSEPH FOSTER AND SONS, Soho Foundry, Preston.—Brochure giving particulars of Lancashire, dry-back, waste heat and Cornish boilers and their fittings.

JAMES KEITH AND BLACKMAN COMPANY, Ltd., 27, Farringdon-avenue, E.C. 4.—Two folders dealing with fans for heating, ventilating, blowing, exhausting, &c.

WILD-BARFIELD ELECTRIC FURNACES, Ltd., North-road, London, N. 7.—A booklet dealing with the testing of metals and the use of the Vickers hardness tester.

BRAITHWAITE AND CO. (Engineers), Ltd., Broadway-buildings, London, S.W. 1.—Brochure illustrating a number of large steel-framed buildings erected by the firm.

PRICE'S PATENT CANDLE COMPANY, Ltd., Battersea, London, S.W. 11.—Two booklets, "Points for the Owners of Marine Motors" and "The Lubrication of Gas and Oil Engines."

GENT AND CO., Ltd., Faraday Works, Leicester.—Book 7, Section 3, "Relay Controls and Relay Contactors for Battery and Service Mains, Alternating Current and Direct Current."

METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., Trafford Park, Manchester.—Leaflet No. 458/1–1 on the firm's latest type of worm geared electric winches for high-speed cargo handling.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., has opened a new depôt at Mervyn House, Frederick-street, Cardiff, for the sale of lamps in the Cardiff district. Sales in the Swansea area will be conducted from the company's existing offices at 62, Wind-street, Swansea.

MUREX, Ltd., of Rainham, Essex, whose business is the treatment of complex ores and the manufacture of various alloys and of carbon free metals, have purchased practically the whole of the issued shares of Alloy Welding Processes, Ltd., of Ferry-lane, Walthamstow, E. 17. Murex, Ltd., own all the share capital of the Premier Electric Welding Company, Ltd., also that of Thermit, Ltd. The works of the Premier Electric Welding Company, Ltd., will shortly be removed to the new works of Alloy Welding Processes, Ltd.

CONTRACTS.

VICKERS-ARMSTRONGS, Ltd., have received an order from Lord Inchcape for an important passenger ship for the Union Steamship Company of New Zealand. The ship will be built at Barrow-in-Furness, and the main propelling turbo-electric unit will be supplied by the British Thomson-Houston Company at Rugby, in collaboration with Vickers-Armstrongs, Ltd.

THE PULSOMETER ENGINEERING COMPANY, Ltd., of Reading, has recently secured the contract for the hydraulic pumping plant for Leith docks. The plant is to consist of two sets for 800 gallons per minute, and one for 600 gallons per minute, each discharging against a pressure of 800 lb. per square inch. The motors are to be suitable for operating on a 6600-volt supply and will be automatically controlled from an accumulator. In addition, a return water pump and feed tanks, two Venturi tubes, piping and valves are to be supplied. The motors will be by Bruce Peebles and Co., Ltd., and the control gear by the Electric Control Company, Ltd.

THE Central Electricity Board has recently placed further important contracts in connection with the electricity schemes which are now being carried into effect. These include :—(1) Contracts for the supply of high-tension cables for the North-West England and North Wales and the South-West England and South Wales Schemes with British Insulated Cables, Ltd.; Prescot, Lancashire; W. T. Glover and Co., Ltd., Manchester; Siemens Bros. and Co., Ltd., London, and Standard Telephones and Cables, Ltd., London. (2) Contracts for switchgear for the Central England, Mid-East England and North-West England and North Wales Schemes with the British Thomson-Houston Company, Ltd., London; Ferguson Pailin, Ltd., Manchester; the General Electric Company, Ltd., Birmingham; Metropolitan-Vickers Electrical Company, Ltd., Manchester, and A. Reyrolle and Co., Ltd., Hebburn-on-Tyne. (3) A contract for the supply of general meters for the North-West England and North Wales Scheme with Landis and Gyr, Ltd., London. The total value of these and other contracts recently placed amounts to nearly £550,000.

"THE WELDER."—Owing to the success with which *The Welder* has met, it has been decided from September onwards to issue it each month instead of bi-monthly.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—The scrutineers appointed at the Ordinary Meeting held on May 1st, 1930, have reported to the President that the result of the ballot to fill the vacancies which will occur in the Council on September 30th next is as follows :—President, Mr. C. C. Paterson, O.B.E.; Vice-president, Mr. R. K. Morcom, C.B.E., M.A.; Hon. Treasurer, Mr. E. Leete. Ordinary members of Council :—Members : Mr. F. W. Crawter, Mr. A. Ellis, Mr. E. W. Hill, Mr. R. P. Sloan, C.B.E., Mr. V. Watlington, M.B.E.; Associate Member Mr. R. Grierson; Associate, Mr. J. F. W. Hooper.

BUSK STUDENTSHIP IN AERONAUTICS.—This studentship has been established in memory of Edward Teshmaker Busk, who in 1914 lost his life while flying an experimental aeroplane. The Trustees hope to make an appointment shortly. It is of the value of about £150, tenable for one year from October 1st; but a student may be re-appointed on the same terms for a second year. It is open to any man or woman being a British subject and of British descent who has not attained the age of twenty-five years on October 1st next. The object of the studentship is to enable the holder to engage in research or preparation for research in aeronautics and specially in those subjects such as stability problems, meteorological questions bearing on flight, or the investigation of gusts, treated either experimentally or mathematically, in which Edward Busk was specially interested. Forms of application for the studentship can be obtained from Professor B. Melvill Jones, Engineering Laboratory, Cambridge, and must be filled up and returned to him not later than July 26th next.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST,	
(1) Native	17/9 to 18/6
(1) Spanish	20/6 to 21/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	20/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 19 6	—
No. 1 Foundry	3 19 0	—
No. 3 Foundry	3 16 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 11 0	3 11 0
No. 1	3 11 6	3 11 6
Cleveland—		
No. 1	3 10 0	3 10 0
Siliceous Iron	3 10 0	3 10 0
No. 3 G.M.B.	3 7 6	3 7 6
No. 4 Foundry	3 6 6	3 6 6
No. 4 Forge	3 6 0	3 6 0
Mottled	3 5 6	3 5 6
White	3 5 6	3 5 6
MIDLANDS—		
(3) Staffs —	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 13 0	—
„ „ Foundry	3 17 0	—
(3) Northampton—		
Foundry No. 3	3 12 6	—
Forge	3 8 6	—
(1) Derbyshire—		
No. 3 Foundry	3 16 0	—
Forge	3 12 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 11 0	—
No. 4 Forge	3 7 0	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 5 6 (*a*)	—
	4 8 6 (*b*)	—
	4 12 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 5 0	—
Second Quality Bars	8 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	10 0 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 7 6	—
Gas Tube Strip	11 2 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 0 0	10 0 0
Ship Plates, ¾in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	12 15 0	12 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 10 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	7 15 0 to 8 0 0	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	9 15 0	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	6 10 0	—
Hoops	9 15 0 to 10 0 0	—
Soft Wire Rods	8 0 0	—
MIDLANDS—		
Small Rolled Bars	7 17 6 to 8 10 0	—
Billets and Sheet Bars	5 18 6 to 6 5 0	—
Galv. Sheets, f.o.b. L'pool	11 17 6	—
Sheets (30 W.G.)	16 7 6	—
Angles	8 7 6	—
Joists	8 10 0	—
Tees	9 7 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/- to 18/3
Block Tin (cash)	131 7 6
„ (three months)	133 0 0
Copper (cash)	48 2 6
„ (three months)	47 18 9
Spanish Lead (cash)	18 5 0
„ „ (three months)	18 1 3
Spelter (cash)	15 18 9
„ (three months)	16 2 6
MANCHESTER—	
Copper, Best Selected Ingots	54 0 0
„ Electrolytic	55 0 0
„ Strong Sheets	81 0 0
„ Tubes (Basis Price), lb.	0 0 11¾
Brass Tubes (Basis Price), lb.	0 0 10¾
„ Condenser, lb.	0 1 0¾
Lead, English	19 17 6
„ Foreign	18 10 0
Spelter	16 17 6
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	2/8½ per lb.	
Ferro Tungsten	2/5½ per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 12 6	7/-
„ „ 6 p.c. to 8 p.c.	£22 10 0	7/-
„ „ 8 p.c. to 10 p.c.	£22 0 0	7/-
„ „ Specially refined		
„ „ Max. 2 p.c. carbon	£33 10 0	10/-
„ „ „ 1 p.c. carbon	£38 0 0	13/6
„ „ „ 0·70 p.c. carbon	£39 0 0	15/-
„ „ „ carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 15 0 for home	
„ „ „	£11 0 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/- per unit	
„ „ 75 p.c.	£19 0 0 scale 7/- per unit	
„ Vanadium	12/9 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	12/6
„ „ Eli	13/-
„ „ Splint	14/- to 15/-
„ „ Trebles	12/- to 12/6
„ „ Doubles	11/9 to 12/-
„ „ Singles	11/- to 11/3
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/3
„ „ Jewel	16/-
„ „ Trebles	12/6 to 13/-
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	10/3 to 12/6
Screened Navigation	16/6 to 17/6
Trebles	13/- to 14/-
Doubles	12/-
Singles	11/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	11/6
Secondary Steam	11/-
Trebles	13/3
Doubles	12/-
Singles	11/-

ENGLAND.

(8) N.W. COAST—	
Steams	20/6 to 21/-
Household	32/- to 51/-
Coke	20/- to 21/-
NORTHUMBERLAND—	
Best Steams	13/6
Second Steams	12/-
Steam Smalls	10/- to 10/6
Unscreened	12/6
Household	25/- to 37/-
DURHAM—	
Best Gas	14/9 to 15/-
Second	12/9 to 13/-
Household	25/- to 37/-
Foundry Coke	24/- to 26/-

SHEFFIELD—	Inland.	
Best Hand-picked Branch	24/- to 25/6	—
Derbyshire Best Bright House	19/- to 21/-	—
Best House Coal	18/- to 19/6	—
Screened House Coal	16/- to 17/-	—
„ „ Nuts	14/- to 16/-	—
Yorkshire Hards	14/- to 15/6	—
Derbyshire Hards	14/- to 15/6	—
Rough Slacks	8/6 to 9/-	—
Nutty Slacks	7/- to 8/-	—
Smalls	3/- to 5/-	—
Blast-furnace Coke (Inland)	15/6 on rail at ovens	
Furnace and Foundry Coke (Export), f.o.b.	17/- to 18/6	

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	20/-
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 18/9
Ordinary Dry Large	17/6 to 18/-
Best Black Vein Large	18/3 to 18/6
Western Valley Large	18/- to 18/3
Best Eastern Valley Large	17/9 to 18/-
Ordinary Eastern Valley Large	17/6 to 17/-
Best Steam Smalls	13/6 to 14/-
Ordinary Smalls	12/6 to 13/-
Washed Nuts	19/- to 22/-
No. 3 Rhondda Large	20/- to 20/6
„ „ Smalls	15/6 to 16/-
No. 2 „ Large	17/- to 17/3
„ „ Through	16/- to 16/6
„ „ Smalls	14/- to 14/3
Foundry Coke (Export)	27/6 to 37/-
Furnace Coke (Export)	21/- to 21/6
Patent Fuel	22/-
Pitwood (ex ship)	27/3 to 27/6
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	35/- to 37/6
Seconds	27/6 to 31/6
Red Vein	23/6 to 27/-
Machine-made Cobbles	41/6 to 45/-
Nuts	40/- to 46/-
Beans	24/6 to 27/6
Peas	20/- to 21/-
Breaker Duff	10/- to 10/6
Rubbly Culm	12/6 to 13/-
Steam Coals :	
Large	19/6 to 20/6
Seconds	18/- to 19/6
Smalls	12/- to 13/-
Cargo Through	15/6 to 16/-

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate : Joists (minimum), 12/6 : Ordinary Ship, Bridge, and Tank Plates and Sections, 10/- if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

Steel Prices.

THE meeting which was held in Paris to complete arrangements for the constitution of the international sales comptoir broke down unexpectedly, at least so far as concerns merchant bars and sheets, through the opposition of Belgian firms, some of which are known to have been selling below official prices for some time past. There is obviously a strong feeling amongst mill and forge owners in Belgium against having their hands tied by international agreements. The Cartel has therefore been obliged to revert to the old system of limiting production and leaving producers to fix their own prices for export. The result is a fall in prices on the international market. French producers declare that the lower prices scarcely cover the cost of production, and they are looking to the future with grave misgiving, and with the fear that competition may produce another crisis in the steel trade. The Cartel is making a vigorous effort to avert this danger. It still hopes to create the international sales comptoir for partly manufactured steel and steel sections, for which purpose another meeting is to be held at Liége. If these negotiations are carried through satisfactorily, and the comptoir comes into operation on August 1st as arranged, the Cartel will continue its functions automatically until the end of the year, by which time it is hoped that the difficulties in the way of forming the comptoir for merchant bars and sheets will have been removed. The Steel Cartel will then be renewed on the basis of minimum selling prices, instead of maximum production, as at present. The Belgian opposition, nevertheless, makes the outlook precarious. Conditional on negotiations for the international comptoir for partly manufactured steel and steel sections being carried through satisfactorily at Liége, arrangements have been completed for the sale of those products in Great Britain through a committee composed of representatives of the different international groups.

New Paris Terminus.

A new scheme has been approved by the Paris Municipal Council for dealing with the traffic on the State railways which has become far too heavy for the Gare St.-Lazare. The first proposal made several years ago was to double the capacity of the St.-Lazare terminus by constructing a station underneath the existing one, so that the high-level platforms would be reserved for the main line traffic and the low-level station would receive the suburban trains. Since Monsieur Dautry became managing director of the State Railways, the main line and suburban traffic facilities have been considerably improved, and apart from a further electrification of the lines there is not much more to be done. The suburban traffic is growing so rapidly that the building of a costly low-level station at St.-Lazare would not solve the problem of dealing satisfactorily with the main line traffic, especially the Transatlantic trains which it is desired should arrive in Paris without crowding and delay. It was proposed as an alternative that the Transatlantic and other long-distance trains should be diverted to the Gare des Invalides, but this scheme was objected to on the ground that the extension of the station and the works involved would spoil the Champ de Mars. There remained the Gare Montparnasse, which is the terminus of the Brittany system, and under the scheme now adopted all the main line traffic will be diverted to that station. It was only recently that the Gare Montparnasse was enlarged by the construction of a station at the side of it. They will both be suppressed, and a vast terminus will be built on another site close by. The new station will have twenty-eight tracks, including six for electric trains. The lines will be quadrupled to Versailles, and they will be improved between that town and Mantes for the express traffic with the Normandy system. All the main lines will eventually go to the Gare Montparnasse, and the Gare St.-Lazare will become a suburban terminus. The Invalides Station will be reserved for electric trains which will run underground through the Champ de Mars, and the station bearing that name will be suppressed. It is intended to employ automatic luminous signalling throughout. The system has proved entirely satisfactory on the suburban lines from St.-Lazare, and is now being extended, and the decision to employ it on the lines leading out of the Gare Montparnasse suggests that its use is likely to become general. The cost of the proposed works is estimated at 700 million francs.

Rolling Stock.

After passing through several years of bad trade, when most of the railway companies' requirements in rolling stock were supplied by Germany on account of reparations, the locomotive and wagon builders find themselves in a better situation, with a prospect that the new programmes of the railway companies will provide them with full employment during the next five years. At the same time, foreign competition has been eliminated and prices have been maintained by the operation of the International Union of Wagon Builders, which is one of the most comprehensive bodies of the kind yet constituted. Not only does it aim at providing facilities for obtaining foreign orders, in the way of standardising as much as is permitted by the variety of foreign specifications, but the members will not lose their quotas if, in any year, they are unable to execute their share of foreign orders. The quotas not utilised can be carried over.

Russian Anthracite.

The Soviet Government is making great efforts to dispose of Donetz anthracite coal in this country, and it seems to be meeting with some success, on account of the low price at which the fuel is sold. The propaganda in favour of Russian anthracite is carried out more particularly at Bordeaux and Rouen, where the Soviet agents are endeavouring to compete with Welsh anthracite in its own strongholds. In the Soviet pavilion at the Bordeaux Fair some surprising figures and diagrams were given of the Donetz coal development. For some time past the imports of Russian anthracite have been increasing, and it remains to be seen how long the competition can continue.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

330,491. August 27th, 1929.—ELECTRIC MOTOR CONTROL SYSTEMS, Leonard Miller, of "Redcot," Ellesmere-road South, Chorlton-cum-Hardy, Manchester; Charles Filmer, of 55, Ashfield-road, Altrincham, Chester; and Associated Electrical Industries, Ltd., of Bush House, Aldwych, Westminster.

This invention relates to electric motor control systems and has for its object a system having characteristics particularly suited to the conditions which obtain in the driving of capstans, winches, &c., namely, a system wherein the driving motor is capable of running at comparatively high speed on light load, whilst, on the other hand, it is capable of exerting relatively great torque at much lower speeds and of being "stalled" by a heavy load without injury. Figs. 1 and 2 are electrical diagrams illustrating the invention using respectively a booster set and a motor generator. In the drawings, A is the capstan motor, B the booster set—Fig. 1—or the motor generator set—Fig. 2—and C are the supply mains from which the power for driving the motor A through the set B is obtained. The armature of the motor is indicated at A, reversal of the capstan being obtained by reversing the armature connections. The armature of the motor of the motor generator or booster set is indicated at D, and E is a shunt field winding for this motor. The armature of the generator of the set B is indicated at F and a separately excited field winding for the generator is indicated at G. A series field winding H is also provided on the generator and connected so as to oppose the field due to the shunt winding G. If desired the motor of the set B may be provided with an auxiliary winding in series with the generator circuit. The generator field winding G is shown as being excited from a potentiometer rheostat K, which may be of the reversing type. With the arrangements

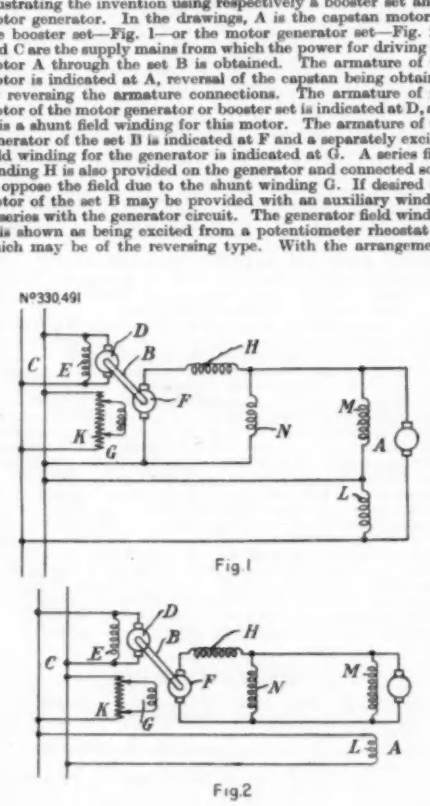


Fig. 1

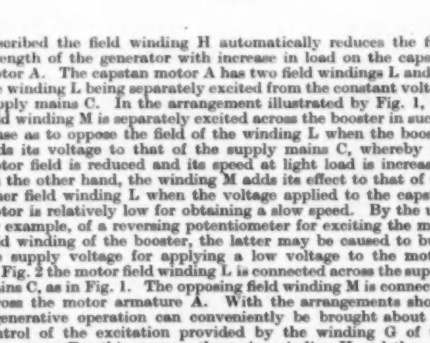


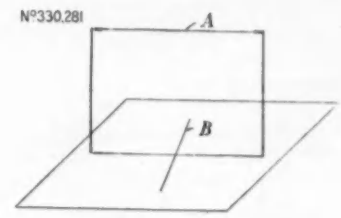
Fig. 2

described the field winding H automatically reduces the field strength of the generator with increase in load on the capstan motor A. The capstan motor A has two field windings L and M, the winding L being separately excited from the constant voltage supply mains C. In the arrangement illustrated by Fig. 1, the field winding M is separately excited across the booster in such a sense as to oppose the field of the winding L when the booster adds its voltage to that of the supply mains C, whereby the motor field is reduced and its speed at light load is increased. On the other hand, the winding M adds its effect to that of the other field winding L when the voltage applied to the capstan motor is relatively low for obtaining a slow speed. By the use, for example, of a reversing potentiometer for exciting the main field winding of the booster, the latter may be caused to buck the supply voltage for applying a low voltage to the motor. In Fig. 2 the motor field winding L is connected across the supply mains C, as in Fig. 1. The opposing field winding M is connected across the motor armature A. With the arrangements shown regenerative operation can conveniently be brought about by control of the excitation provided by the winding G of the generator. For this purpose the series winding H and the self-excitation winding N of the generator may be cut out, although this is not necessary, since the current in the winding H will be reversed relatively to that in N during regenerative operation. In fact, the winding H may be advantageous during regeneration and add to stability. The winding M of the capstan motor may be left in or cut out of circuit during regenerative operation. It will be understood that speed regulation other than that provided automatically in accordance with the invention may be obtained by means of a field rheostat connected in the generator field circuit. In the case of the booster set the reversing potentiometer K may be employed for the purpose.—*June 12th*, 1930.

TELEGRAPHS AND TELEPHONES.

330,281. March 4th, 1929.—TRANSMISSION OF RADIO SIGNALS, *Stanley Gordon Sinclair Dicker, of 20 to 23, Holborn, London, E.C.* 1.

A well-known method of avoiding the occurrence of fading by interference phenomena is the emission of linearly polarised carrier waves, the plane of polarisation of which rotates at a frequency other than the frequency of the carrier waves. For ensuring such a result various devices have been suggested based on the supposition that the earth is a perfect conductor. When, however, the earth is truly regarded as a semi-conductor, or even as a poor conductor, the known devices are found to be unnecessarily complicated. It is possible, however, to secure the desired result by means of a single aerial by carrying out a process according to the invention in which the high-frequency oscillations and the medium frequency oscillations (one of these frequency oscillations being modulated by speech currents or other low-frequency currents) are fed simultaneously to a modulator and the oscillations in the output circuit of the modulator are fed to a single horizontal antenna. In order to obtain a rotating plane of polarisation it is necessary for the carrier wave and medium frequency wave to be non-linearly combined. This may be effected, for example, by feeding the two waves simultaneously to the input circuit of a modulator valve having its output circuit connected to the antenna. If the high-frequency carrier is modulated the antenna will radiate a carrier wave and two modulated high-frequency waves. If the high-frequency wave is not modulated the medium frequency wave will be

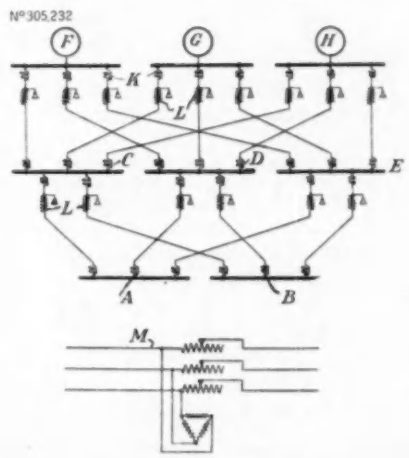


modulated and combined with the high-frequency carrier, in which case the result is the same as before, but for the fact that the high-frequency carrier is not modulated. The medium frequency employed may be 10,000 cycles, or more. The method of the invention is particularly applicable to the radiation of very short waves—10 m. to 40 m. Referring to the diagram an aerial A emits modulated high-frequency oscillations, the polarisation surface of which rotates at medium frequency. The conductivity of the earth on which the antenna masts are erected can be improved and controlled by arranging along the earth, at any angle with the direction of the aerial wire, one or more conductors B, the length of which is of the same order of magnitude as the length of the aerial.—*June 4th*, 1930.

TRANSMISSION OF POWER.

305,232. February 1st, 1929.—REGULATING THE DISTRIBUTION OF CURRENT IN THE INTERCONNECTING FEEDERS OF ALTERNATING-CURRENT ELECTRIC SUPPLY SYSTEMS, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

For the purpose of regulating the distribution of current in the interconnecting feeders of alternating-current electric supply systems in accordance with this invention, transformers are used which introduce additional voltages and which are constructed as regulating core transformers. Two sub-stations A and B are directly connected to consumers. Feeders are provided between each of these stations by way of each of three distributing stations C, D, and E, as well as between these and generators F, G, and H in various power-houses. The individual feeders are provided with choke coils K and with stationary booster transformers L, arranged in accordance with the invention. Both the sub-stations A and B—are connected with each

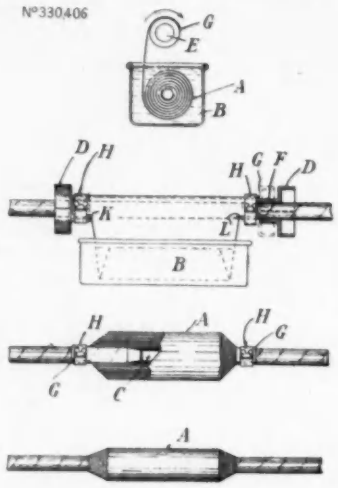


generating station by two feeders which are passed through different distributing stations; for example, the sub-station A is connected with the generator G by a feeder which passes through the distributing station E and also by a feeder which passes through the distributing station C. The additional transformers, according to the invention, are inserted in these feeders which are closed to form a ring. In the lower diagram M is one of the feeders included in the ring main, in which the regulable secondary winding of the booster transformer is connected. The delta-connected primary winding of the booster transformer is connected to the ring main feeder M. The connections to the primary windings of the transformer are on the cyclic change principle. The result of this arrangement is a 90 deg. phase-displacement in the additional voltage supplied to the feeder. The booster transformer may likewise be of a construction, whereby two voltages, regulable independently of one another, may be introduced into the feeder, the voltages being displaced in phase by 90 deg. relative to one another. In this arrangement, one of these voltages is in phase with the fundamental voltage of the line, the other voltage being displaced by 90 deg. relatively to the first. The normal transformers of the system have been omitted for the sake of clearness.—*June 2nd*, 1930.

330,406. June 12th, 1929.—ELECTRIC CABLE JOINTS, Siemens Brothers and Co., Ltd., of Caxton House, Tothill-street, London, S.W. 1; James Riedl, of 48, Waverley-road, London, S.E. 18; and Henry Gurney Wood, of "Kinross," Leesons-hill, Chislehurst, Kent.

In accordance with this invention the insulating wrapping paper A is tapered along its length and is rolled loosely on a rod with its wider end on the outside, and when it is to be applied to a joint, it is placed in a bath B of hot insulating compound placed conveniently below the joint. In the example, the core of the cable has been cut away in a taperng fashion, and after the conductors have been sweated into the socket C, the space between the tapered ends of the core over the joint is built up with insulating tape until the external diameter of the core is reached. The split bearings D are then placed over the core E of the cable on which they are a loose fit, one being provided on each side of the joint. The halves of the bearings lock together by means of dove-tails or spigots. Each bearing has a sleeve F on which tabs G on the wide end of the wrapping paper are clamped by means of the adjustable clamps H. The tabs may be formed by a sudden increase in the width of the paper at the points K and L for a

short distance from the end of the sheet of paper. The tabs being clamped firmly to the bearings D, the latter are rotated and the paper is wound loosely over the joint. When all the paper has been wrapped over the joint, the clamps are slackened and the bearings removed. The clamps are then readjusted to hold the paper firmly to the core. With the paper clamped to the core, it is then tightened on to the joint by gripping it and rotating it with the hand in the opposite direction to that

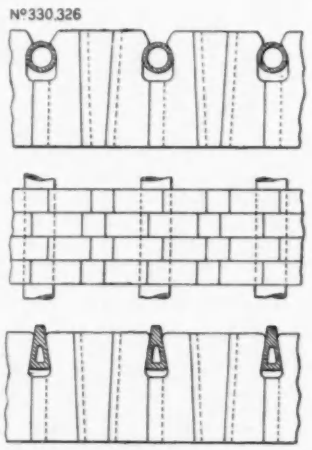


shown by the arrow. When the tightening process is completed the clamps are removed and the joint allowed to cool. The outside of the paper is kept covered by cool compound or is immersed in compound while cooling, so that any contraction of the compound in the paper or between the layers is made good from the outside without the formation of vacuous spaces. When the joint is cool, the outside layer of paper, which has been gripped with the hands, may be removed and the joint assumes the appearance as shown in the bottom illustration.—*June 12th*, 1930.

FURNACES.

330,326. March 18th, 1929.—SUSPENDED FURNACE ARCHES, A. Reppman, 150, Queen Victoria-street, London, E.C. 4.

The invention has for its object to provide a construction and arrangement of the blocks or bricks to enable them to be securely positioned whilst permitting easy replacement of any defective portion of a furnace roof without the necessity of

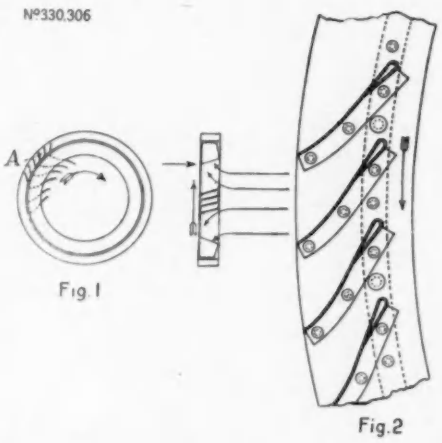


dismantling any part except the particular portion requiring replacement. As will be seen from the drawing the roof is built up in groups of three wedge-shaped blocks, suspended by dovetail recesses from steel joists. The blocks mutually wedge one another in place, but can easily be removed if the centre one of any group of three is lifted.—*June 12th*, 1930.

PUMPING AND BLOWING MACHINERY.

330,306. March 6th, 1929.—FANS, R. W. Allen, Queen's Engineering Works, Bedford.

This fan is claimed to be more efficient and quieter than the normal centrifugal fan. The peculiarity lies in the fact that the

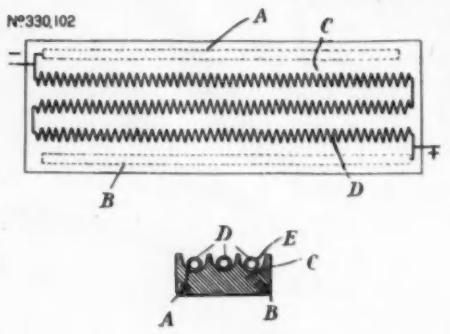


casing is provided with guide vanes A—see Fig. 1. These vanes are set obliquely to the axis and their sectional form is shown in Fig. 2.—*June 6th*, 1930.

LIGHTING AND HEATING.

330,102. May 6th, 1929.—ELECTRIC HEATING ELEMENTS, Herbert Henry Berry and Claude Arthur Painton, both of 85 and 86, Newman-street, London, W. 1.

This invention relates to electric heating elements, and refers more particularly to a means for preventing electrolytic corrosion of the resistance wires at the terminal ends of the wires where they are in contact with their ceramic support. The rods A B are embedded or otherwise conveniently arranged in the insulating panels C in parallel relation to the resistance wires D, which are disposed in grooves, such as E. One end of the rod A is connected with one end of the wire D whilst its other end is free and one end of the rod B is connected with the



other end of the wire and has one end free. In use it is found that the bar connected with the negative end of the resistance wire is the one that is brought into operation, the small leakage current that would normally pass between the ends of the wire by way of the panel and produce corrosion at the negative end of the wire passing to the rod and producing harmless corrosion at the bar instead. By providing two rods it is immaterial which end of the resistance wire is the negative one, since each rod functions in like manner. The panel may consist of a number of insulating blocks, which are laid side by side and the rods A and B may be adapted to tie these blocks together to produce a built-up element.—*June 5th*, 1930.

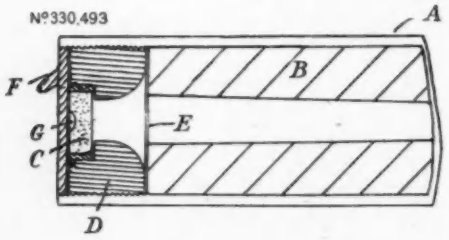
309,536. March 2nd, 1929.—INCANDESCENT BODIES, SUCH AS FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS, VACUUM TUBES AND THE LIKE, Siemens and Halske Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

This invention relates to incandescent bodies, such as filaments, and in particular such as are for use in incandescent lamps, vacuum tubes, &c., and which are highly heated in vacuum or in inert gases, such, for instance, as nitrogen, and the rare gases. The object of the invention is to provide an incandescent body consisting of tungsten and eka-manganese 75. The incandescent body has a core of tungsten and a coating surrounding this core, of eka-manganese 75, or of an alloy of eka-manganese 75 and wolfram. It has been shown that such an incandescent body withstands a considerably greater load than a pure tungsten incandescent filament. Tungsten begins at comparatively low temperatures of little over 2000 deg. to volatilise in a prejudicial manner on the passage of the current. This volatilisation is largely prevented by a thin coating of eka-manganese 75, so that the incandescent body attains a longer life under equal conditions, or may be correspondingly more heavily loaded. Such an incandescent body has the advantage of cheapness as compared with bodies of pure eka-manganese. Eka-manganese or rhenium is the newly discovered chemical element which, in the periodic system of classification of the chemical elements, bears the classification number 75.—*June 2nd*, 1930.

MISCELLANEOUS.

330,493. July 19th, 1929.—LIFE-SAVING ROCKETS, E. F. Spanner, 13, Shooter's Hill-road, Blackheath, London, S.E. 3.

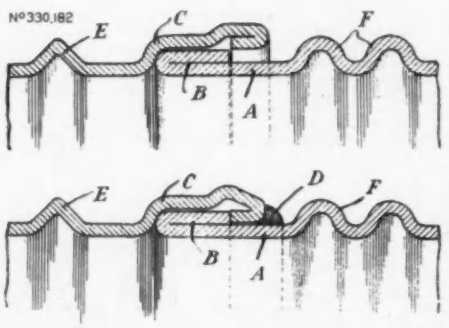
This rocket is in two distinct sections contained in the tube A. One section comprises the propellant B and the other the explosive cartridge C. There is also a choke piece D. The propellant



is kept in place by the diaphragm E, and the cartridge is protected by the watertight cover F. When required, the cover F is stripped off and the rocket is dropped into a firing tube. The percussion cap G is struck, and the cartridge ejects the rocket from the tube, at the same time lighting the propellant.—*June 12th*, 1929.

330,182. August 2nd, 1929.—PIPE JOINTS, Mannesmannröhren-Werke, of 1B, Berger Ufer, Düsseldorf, Germany.

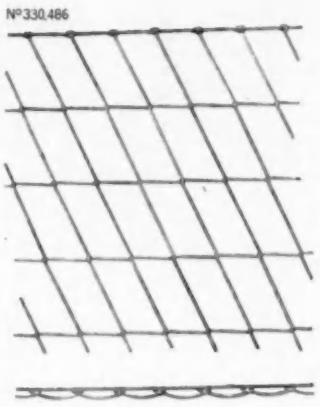
This invention relates to welded spigot and socket pipe joints



in which a welded seam is employed, and wherein means are provided to relieve the welded seam of undesired stresses. The end of a pipe A is folded back, as indicated at B, through an angle of 180 deg., and inserted into a socket C, which is folded inwardly through an angle of 180 deg. prior to the insertion of the end of the pipe A. After the pipe A has been inserted into the socket to constitute the joint, the inturned edge of the socket is forced towards the pipe A, so that the edge engages the edge of the folded portion B of the pipe A in the manner shown in the lower illustration. The joint is then welded as indicated at D. Circumferential corrugations E F may be provided upon the pipes, either upon one or upon both sides of the joint. The corrugations may be angular in cross section, as indicated at E, or they may be semi-circular in cross section, as indicated at F.—*June 5th*, 1930.

330,486. October 23rd, 1929.—WIRE FENCING, *W. W. Triggs, Marks and Clerk*, 57, *Lincoln's Inn-fields, London, W.C.* 2.

The object of this invention is to provide a wire fencing which can be strained longitudinally without the meshes being distorted and the width, or height, being consequently reduced. The inventor so forms the mesh—as shown—that there are virtually longitudinal strands of wire, although the netting is woven transversely. No description is given of the process of manufacture.—*June 12th*, 1930.



Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF NAVAL ARCHITECTS.—Summer meeting at Liverpool.

WEDNESDAY, JULY 23RD.

INSTITUTION OF CIVIL ENGINEERS: BIRMINGHAM AND DISTRICT ASSOCIATION.—Visit to the Leicester Corporation Waterworks. Leave Birmingham at 9 a.m.

OVERHEAD LINES ASSOCIATION.—Summer meeting at Aylesbury, Bucks. Leave Marylebone 10.5 a.m. Meeting at the electricity works at 11.30 a.m.

WEDNESDAY TO WEDNESDAY, SEPTEMBER 3RD TO 10TH.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—Bristol meeting. The presidential address, by Professor F. O. Bower, will deal with "Size and Form in Plants." Evening discourses will be given by Professor E. V. Appleton, F.R.S., on "Wireless Echoes," and by Dr. R. E. Slade on "The Nitrogen Industry and our Food Supply." Evening receptions and excursions to points of scientific interest, works, &c., in the locality will be arranged.

THURSDAY TO SUNDAY, SEPTEMBER 4TH TO 7TH.

INTERNATIONAL CONGRESS OF CONSULTING ENGINEERS.—Fifth Congress at Vienna.

WEDNESDAY TO TUESDAY, SEPTEMBER 10TH TO 16TH.

INSTITUTE OF METALS.—Annual autumn meeting at Southampton.

FRIDAY, OCTOBER 31ST.

OVERHEAD LINES ASSOCIATION.—Annual conversazione.

THE MANUFACTURE OF ELECTRIC BATTERIES.—On Friday last a party of naval engineers and naval architects was invited by the directors of the Chloride Electrical Storage Company, Ltd., to pay a visit of inspection to the company's works at Clifton Junction, near Manchester. The workshops cover an area of 7 acres, standing on some 40 acres of land and are claimed to be the largest of their kind in the British Empire. Some idea of their growth will be gathered from the covered area, which has increased by 100,000 square feet in the last five years, and extensions are still being made. The application of storage batteries to marine service forms a very important section of the firm's business, the widest application of batteries at sea being for ship's wireless. The most recent developments in the application of batteries in the mercantile marine include such duties as lighting in port, when the generators are shut down, emergency lighting and steering in the event of failure of the power, panic lighting, carrying the peak of the load in winch and windlass operation and supplying light at fishing grounds. Exide-ironclad batteries for under-water propulsion of submarines were seen in construction. In this type of battery the active material is enclosed in slitted ebonite tubes and is thus held securely in contact with the grid, which conducts the current to the terminals. The slitting of the ebonite is so fine that the electrolyte is allowed free diffusion to the active material. The negative plate consists of a hard lead alloy grid with a lattice structure, forming a flat cage which holds the active material securely in the form of continuous strips and the intimate contact between the grid and the active material results in low internal resistance and renders the plate unaffected by vibration. The plates are separated by wooden partitions, which are chemically treated before use. One such battery for submarine propulsion weighs about 150 tons. The visitors were much impressed by the admirable arrangements in the welfare department and by the obviously healthy appearance of the workers, both male and female.